THE EXPLOSIVES ENGINEER

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Forerunner of Progress in Mining, Quarrying, Construction

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Views and opinions expressed by the authors of articles in this publication are their own, and they do not necessarily represent those of the publisher.

Once again we are proud to present to our readers a complete report of the results of the annual National Safety Competition. This safety movement, sponsored by THE EXPLOSIVES ENGINEER and conducted by the United States Bureau of Mines, has helped to produce a marked reduction in the accident rates in the mines and quarries enrolled.

A review of the figures presented by John C. Machisak, chief, Branch of Accident Analysis, United States Bureau of Mines, in his annual report beginning on page 103, shows the following noteworthy accomplishments during 1957:

The 619 mines and quarries participating in the competition established the lowest all-time combined accident-frequency rate of 18.31 injuries per million man-hours.

In the 1957 competition, 272 of the 619 participating operations reported no disabling work injuries. This represents 44% of the total mines and quarries competing. Compared with seven accident-free operations in 1925, the first year of the competition, it is indeed a remarkable achievement in accident prevention.

* * *

The southwest corner of Virginia has been generously endowed by nature with large deposits of high-grade bituminous coal suitable for a wide variety of industrial uses.

Located in this area are the extensive mining operations of the Clinchfield Coal Company and generating plants of the Appalachian Electric Power Company. The Norfolk and Western Railway Company serves this area. These three progressive organizations are engaged in huge expansion programs, each independent but to a great extent interrelated because the success of any one depends upon the success of the others.

More complete information on this project is given in W. R. Hubble's article on page 115.

* * *

Long a source of troublesome floods, the cantankerous Missouri River is gradually being curbed by the execution of flood-control plans of the U. S. Army Corps of Engineers. One part of the extensive program is the building of the huge Oahe Dam on the Missouri River.

Some realization of the scope of this operation may be obtained from the following statistics: a reservoir 250 miles long will be created by the dam; flooding will be controlled from Pierre, South Dakota, to the mouth of the Missouri River at St. Louis, a distance of 1,123 miles; the dam will be 9,300 ft. long, 242 ft. high, and will contain 91,000,000 cu. yd. of earth; electrical power generated will reach 595,000 kw.

For more details concerning this gigantic undertaking, read the article by L. H. Houck starting on page 121.

* * *

Creede, one of the wildest and most famous of the old-time mining camps of the West, was made even more famous when Cy Warman, a newspaperman and editor of the early '80's, published his poem "Creede," in which he composed the well-known and oft-quoted lines:

"It's day all day in the daytime,
And there is no night in Creede."

Warman's most famous effort was a song of the yesteryears, "Sweet Marie."

Charles F. Thomas, who knows most of the mining camps of the West, poetically describes the Creede of today in "Ghost Town." Please turn to page 120.

EDITORIAL STAFF: JAMES J. O'NEILL, *Managing Editor;* THOMAS E. MILLER, *Contributing Editor;* GERTRUDE A. DONNELLY, *Associate Editor;* EDWARD L. GRANT, *Art Editor;* HOWARD B. DICKSON, *Production Manager;* CHARLES E. RABENOLD, *Advertising Manager;* MONTGOMERY R. BUDD, *Director.*

SUBSCRIPTION RATES: *United States and Canada*—One Year, $1.50; Single Copies, $.30. *Limited Subscriptions Only to Other Countries*—One Year, $2.50; Single Copies, $.50.

THE EXPLOSIVES ENGINEER, 613 DELAWARE TRUST BUILDING, WILMINGTON, DELAWARE. PRINTED IN UNITED STATES OF AMERICA.

PUBLISHED BY *HERCULES POWDER COMPANY*

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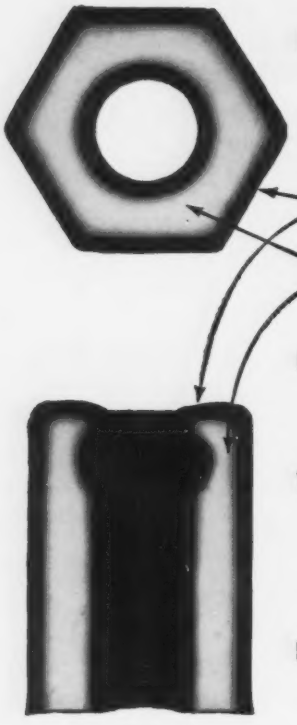
VOL. 36 NO. 4 JULY-AUGUST, 1958 EPA

GARDNER-DENVER DRILL STEEL

Cuts drilling costs...reduces steel breakage



Made like tough rock drill parts

Gardner-Denver sectional drill steel is carburized to produce the same hard case, soft core structure that produces superior rock drill parts. Shot-peening increases fatigue resistance.

High-tensile surface strength resists abrasion, corrosion, nicking and down-the-hole gaff.

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Gardner-Denver uses special alloy steels to insure uniform hardening and longer service life.

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The extra long threads and couplings of Gardner-Denver design provide greater strength and durability. Couplings are also carburized to provide a hard surface on the threads and a tough core.

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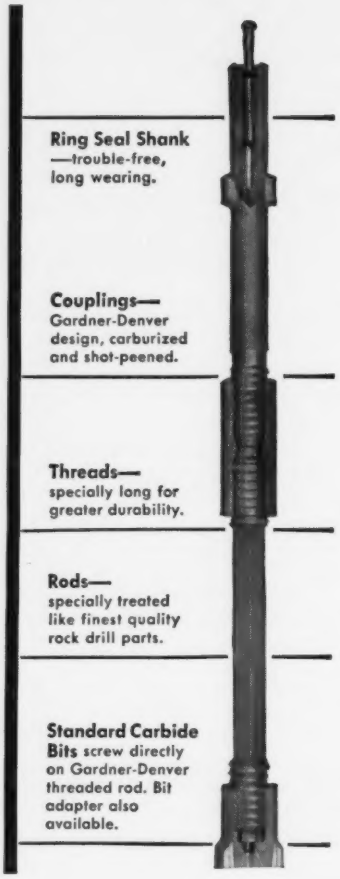
One user drilling hard rhyolite reports steel breakage reduced by 45% after changing over to Gardner-Denver drill steel.

Drill steel represents a large percentage of drilling costs. Gardner-Denver drill steel costs less to use. Write for information.


Ring Seal Shank —trouble-free, long wearing.
Couplings— Gardner-Denver design, carburized and shot-peened.
Threads— specially long for greater durability.
Rods— specially treated like finest quality rock drill parts.
Standard Carbide Bits screw directly on Gardner-Denver threaded rod. Bit adapter also available.

Gardner-Denver Sectional Drill Rod Specifications

	CL5-200 Series	CL5-400 Series	CL5-600 Series	CL5-700 Series	CL5-1000 Series
Thread Size	1 1/16"	1 1/4"	1 1/2"	1 3/4"	2 1/2"
Recommended Drill Size	3" and smaller	4" and smaller	4" and 4 1/2"	4" and 4 1/2"	5 1/2"
Recommended Bit Size	1 5/8" to 1 7/8"	2" to 2 1/4"	2 3/8" to 2 3/4"	3" to 4"	4", 4 1/2" and 5"
Rod Sizes	7/8" Hex.	1" Hex.	1 1/4" Hex.	1 1/4" and 1 1/2" Hex.	1 7/8" Hex.
Rod Lengths	2' to 20'	2' to 20'	2' to 20'	2' to 20'	4' to 20'
Coupling Diameter	1 7/16"	1 3/4"	2 1/8"	2 1/2"	3 3/8"
Ring Seal Shank	1" Hex. Collared 1 1/4" Rd. Lugged	1 1/4" Rd. Lugged 1 1/2" Rd. Lugged	1 1/4" Rd. Lugged 1 1/2" Rd. Lugged	1 1/2" Round	2 1/2" Round

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

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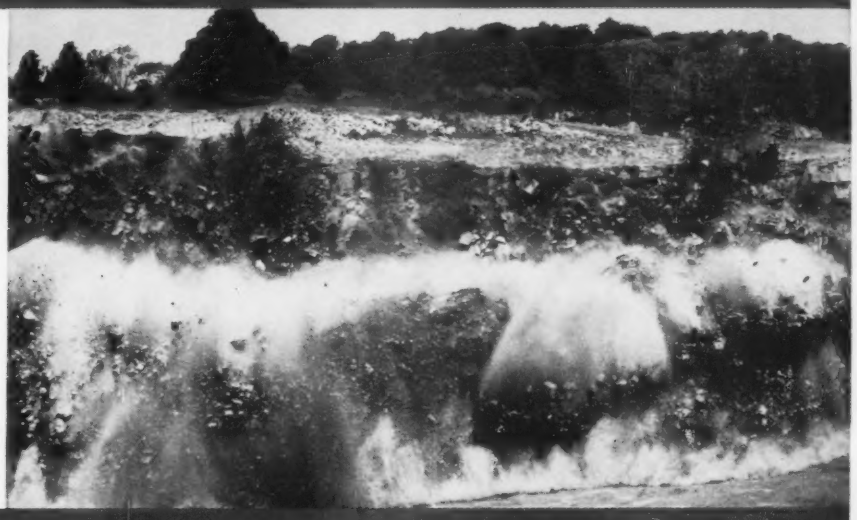

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THEODORE C. COOKE

Theodore C. Cooke

PRESIDENT AND TREASURER
THE LYNN SAND & STONE COMPANY
HUME PIPE OF NEW ENGLAND, INC.

A Biography

THE career of Theodore C. Cooke, president of The Lynn Sand & Stone Company and Hume Pipe of New England, Inc., is a record of early devotion and intensive application to a chosen field of business enterprise. His thorough knowledge of the crushed stone industry, sound business judgment, and lots of hard work have been contributing factors in the successful development of the companies he heads.

Ted, as he is known to his friends and associates, was born July 18, 1903, in Hartford, Connecticut, the son of James H. and Lucy (Carter) Cooke. His father, one of the pioneers in the crushed stone business, built his first plant in 1892, at Plainville, Connecticut, with timber he cut and sawed himself. Later, he built or remodeled five crushed stone plants in Connecticut and one in Massachusetts.

After attending Hartford's Noah Webster Grade School and the Hartford High School, Ted completed his formal education at the Wentworth Technical Institute in Boston. During his student days, his extracurricular activities were limited because of his preference for traveling with his father to the family's stone quarry and plant properties in New England.

Ted began his active career in the crushed stone industry in 1924 when he went to work as one of the track gang in the quarry of The Lynn Sand & Stone Company at Swampscott, Massachusetts. After a year on this assignment, he was moved up to locomotive operator. Two years later, he was promoted to quarry superintendent. In 1930, he was elected president and treasurer of the company, and treasurer of Hume Pipe of New England, Inc., of Swampscott. At the same time, he was made president and treasurer of Hartford Sand & Stone Company in Connecticut; later, this property was sold. In 1957, he was elected president of the Hume Pipe organization and re-elected treasurer of this company.

Ted holds several patents on tools and equipment that are widely used in stone quarries and plants, including a drop ball for the secondary reduction of big boulders. In conjunction with his father, he helped to design an unusual heavy-duty primary crusher which Allis-Chalmers Manufacturing Company makes and distributes under the name of "Type C" crusher. He also has made important contributions to the advancement of dust control in crushed stone plants.

Mr. Cooke's other business interests include active participation in the affairs of the National Crushed Stone Association—twenty years as a director and two terms as president, in 1954 and 1955; a member of the National Ready Mixed Concrete Association; and a member of the National Concrete Pipe Association.

He is a member of the Rotary Club of Swampscott, and was its president in 1946. He is also a member of the Wayfarers Lodge, A. F. & A. M., in Swampscott.

Theodore C. Cooke married Florence Phillips in 1929, in Swampscott, Massachusetts. They have two sons and one daughter: James H. II, chief engineer of The Lynn Sand & Stone Company; Phillips C., vice president and general manager of Hume Pipe of New England, Inc.; and Nancy K., a student at Colby Junior College in New London, New Hampshire. They also have two grandchildren. The family home is at 189 Bradlee Avenue in Swampscott.

Ted's principal hobby is skiing which, incidentally, is shared by everyone in the family. Two of his sons were on the Dartmouth College ski team, and a third son, who died at the age of twenty-one, was manager of the ski team at Dartmouth. Ted also finds relaxation in collecting stamps with his children and, when opportunity permits, in traveling around the country with his family.

THE WINNERS 1957

Anthracite
PINE KNOT COLLIERY
READING ANTHRACITE COMPANY
Minersville, Pennsylvania

Bituminous-Coal
REPUBLIC MINE
REPUBLIC STEEL CORPORATION
Elkhorn City, Kentucky

Metal
CALLOWAY-MARY MINE
TENNESSEE COPPER COMPANY
Copperhill, Tennessee

Nonmetallic
BELLEFONTE MINE
NATIONAL GYPSUM COMPANY
Bellefonte, Pennsylvania

Open-Pit
MISSISSIPPI GROUP MINE
HANNA ORE MINING COMPANY
Keewatin, Minnesota

Quarry
CALCITE QUARRY
UNITED STATES STEEL CORPORATION
Rogers City, Michigan

"Let the worker carry around with him a mental picture of his wife and child, whose happiness depends upon his safe return after the day's work, and these loved ones become his surest sentinels of safety."

January, 1925—The Explosives Engineer

THE National Safety Competition OF 1957

The 619 participants, with a record of 18.31 disabling injuries per million man-hours worked, established the lowest injury-frequency rate in the 33 years of the annual competition

JOHN C. MACHISAK*

For the past 33 years the National Safety Competition has been a powerful instrument in the nation's attack upon disabling work injuries in the mineral industries. It has demonstrated beyond doubt that well-organized and well-administered programs, reinforced by common incentive, can do much to prevent work injuries in mines and quarries.

The 619 participants in the 1957 annual competition deserve credit for establishing the lowest combined injury-frequency rate on record, having bettered the previous all-time low rate attained in 1956. These mines and quarries report 18.31 disabling injuries per million man-hours, thus bettering the 1956 record-low injury-frequency rate of 18.98 injuries per million man-hours. While the 1957 injury-severity rate of 4,625.7 days charged per million man-hours is not a new record, in only two previous contests have lower injury-severity rates been reported: 4,051.2 days were charged per million man-hours worked in 1953, and for the record-low year (1955) 3,871.9 days were reported.

Another noteworthy accomplishment credited to the 1957 National Safety Competition is the substantial increase in the number of operations having no disabling work injuries throughout the year. It is indeed commendable that 272 of the participating plants (44% of the total) were able to report that NO DISABLING WORK INJURIES occurred during 1957 while their employes were exposed to the hazards of mining and quarrying for a combined total of 23 million hours. In the 1956 contest, with an enrollment of 525, the injury-free operations numbered 200 (38% of the total), and the exposure was slightly more than 20 million man-hours. The number of contestants reporting injury-free oper-

*Chief, Branch of Accident Analysis
Division of Safety, Bureau of Mines
United States Department of the Interior

Photograph, courtesy of Fairmont Machinery Co.

PREPARATION UNIT—REPUBLIC MINE: This photograph of the Republic Mine at Elkhorn City, Kentucky, shows the modern preparation unit where the coal is washed and made ready for shipment. Republic's miners worked 413,198 man-hours during 1957 without a lost-time injury.

WAITING FOR THE MAN-TRIP: Miners at the Republic Mine of Republic Steel Corporation wait for the man-trip that will take them underground. Working two shifts a day, this modern mine employs approximately 200 men underground.

ations within their plants has increased rather steadily over the years—from 7 in 1925 to 272 in 1957. These latest perfect records are distributed among the competitive classifications as follows: quarries, 191; open-pit mines, 43; nonmetallic underground mines, 29; bituminous-coal underground mines, 6; and metallic underground mines, 3.

The National Safety Competition is an annual contest conducted by the U. S. Bureau of Mines to promote and maintain interest in safety among the employes and the management of the nation's mines and quarries. Companies participating in the contest are grouped into six classes: anthracite underground mines, bituminous-coal underground mines, metallic underground mines, nonmetallic underground mines, open-pit mines, and quarries. The top winner in each group is the contestant with the lowest injury-severity rate for the contest year, that is, the fewest number of days lost through disabling injuries (including fatalities) per million man-hours of work. If two or more competitors have the same injury-severity rate at the close of the competition, the winner is

then determined by the total number of man-hours worked.

Each of the six winning operations is awarded a Sentinels of Safety trophy and flag, which are provided by THE EXPLOSIVES ENGINEER. In addition, the Bureau of Mines provides an individual Certificate of Accomplishment in Safety, which is presented to each employe and officer in the six winning companies. The Bureau of Mines also provides a Certificate of Achievement in Safety to the next four plants after the winner in each of the six classes, as well as to each injury-free mine and quarry that accumulated 30,000 or more man-hours during the contest year. To insure impartiality, the rules of the National Safety Competition provide for a Committee of Award to select the winner in each competitive class of the contest. The committee comprises seven men, prominent in the mineral industry, who have no connection with the Bureau of Mines.

Committee of Award

The members of the Committee of Award that selected the winners of the Sentinels of Safety trophy in 1957 were: G. Donald Kennedy, president, Portland Cement Association; L. Newton Thomas, president, National Coal Association; Dr. Augustus B. Kinzel, president, American Institute of Mining, Metallurgical, and Petroleum Engineers; Ned Dearborn, president, National Safety Council; Charles Ferguson, director, Safety Division, United Mine Workers of America; Howard I. Young, president, American Mining Congress; Franklin G. Pardee, president, Lake Superior Iron Ore Association.

The Bureau of Mines submitted to the Committee of Award the contest records of the five operations in each competitive class having the lowest injury-severity rate during the 1957 competition. The committee then selected the following winners:

The Six Winners

Anthracite: Pine Knot Colliery, Minersville, Schuylkill County, Pennsylvania. Mine is operated by the Reading Anthracite Company.

Bituminous-Coal: Republic Mine, Elkhorn City, Pike County, Kentucky. Mine is operated by the Republic Steel Corporation.

Metal: Calloway-Mary Mine, Copperhill, Polk County, Tennessee. Mine is operated by the Tennessee Copper Company.

Nonmetallic: Bellefonte Mine, Bellefonte, Centre County, Pennsylvania. Mine is operated by the National Gypsum Company.

Open-Pit: Mississippi Group Mine, Keewatin, Itasca County, Minnesota. Mine is operated by the M. A. Hanna Company (Hanna Ore Mining Company).

Quarry: Calcite Quarry, Rogers City, Presque Isle County, Michigan.

CALLOWAY-MARY MINERS: These employes of the Calloway-Mary Mine of Tennessee Copper Company, Copperhill, Tennessee, won the Sentinels of Safety trophy in the 1957 contest. Many of the men shown helped this mine win the trophy in the 1953 competition.

Quarry is operated by the Michigan Limestone Division of United States Steel Corporation.

Anthracite Mines

The Pine Knot Colliery of Reading Anthracite Company, Minersville, Schuylkill County, Pennsylvania, was awarded the Sentinels of Safety trophy for achieving the best safety record for the anthracite-mines group. This mine operated a total of 160,915 man-hours, with 12 disabling work-injuries which entailed a time loss of 312 days. Its award-winning injury-severity rate of 1,938.9 days charged per million man-hours of exposure in 1957 is substantially below the rate earned in 1956, the first year the Pine Knot Colliery entered the National Safety Competition. In 1956 the mine recorded 8,109.5 days charged per million man-hours of work.

Twelve anthracite underground mines were entered in the 1957 competition, the same number as in 1956. The 1957 injury experience of the group was not so favorable as in 1956. A total of 313 injuries occurred in 3,665,068 man-hours worked in 1957, resulting in an injury-severity rate of 13,790.7 days charged per million man-hours. This is well above the corresponding rate of 11,510.3 in 1956. However, the injury-frequency rate of 85.40 in 1957 was 8% lower than the 92.59 recorded for 1956.

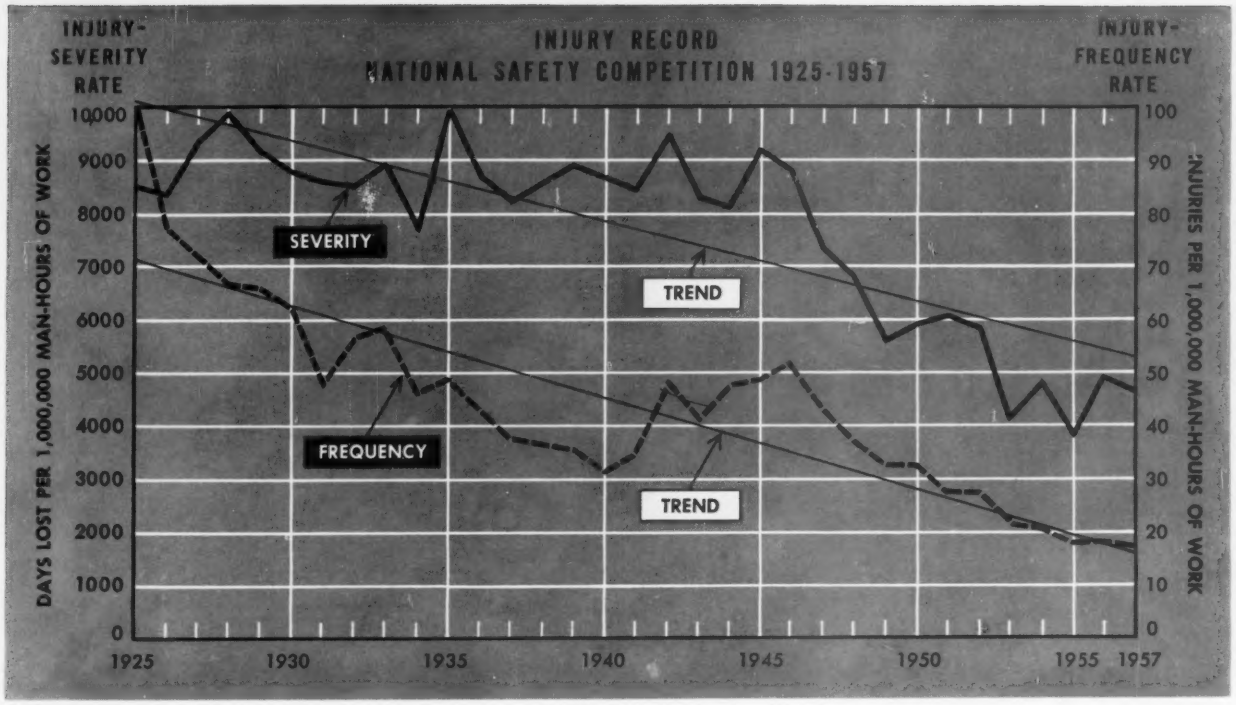
Bituminous-Coal Mines

The Republic Mine of the Republic Steel Corporation, Elkhorn City, Pike County, Kentucky, won the Sentinels of Safety trophy for the best safety record among underground bituminous-coal mines in 1957. The mine operated 413,198 man-hours in 1957 without a single lost-time injury. This is the first year the Republic Mine has won the trophy, although it did receive honorable mention in 1956.

During its 12 consecutive years of competition, the Republic Mine has worked slightly over 7 million man-hours, with an injury-frequency rate of 11.22 and an injury-severity rate of 10,205.4 per million man-hours of exposure to mining hazards.

Sixty-seven underground bituminous-coal mines entered the 1957 competition. They reported 557 disabling work injuries, of which 29 were fatalities, while operating more than 38 million man-hours. As a result, their injury-frequency rate of 14.44 is the second lowest for the group in the 33-year history of the competition. The record-low year was 1956, when the frequency rate was 14.35. The injury-severity rate for the underground bi-

CALLOWAY-MARY SURFACE PLANT: This modern headframe, bins, and hoist house, now in the course of construction, will contain the very latest in equipment. The new facilities are scheduled to be ready for use in late 1958.



SALIENT FEATURES OF THE NATIONAL SAFETY COMPETITION

1957

Type of mine	*Number of mines*	*Man-hours*	*Fatal injuries*	*Nonfatal injuries*	*Total*	*Days of disability*	*Frequency rate*	*Severity rate*
Anthracite	12	3,665,068	4	309	313	50,544	85.401	13790.740
Bituminous-coal	67	38,584,529	29	528	557	242,335	14.436	6280.626
Metal	58	23,178,147	15	680	695	130,747	29.985	5640.960
Nonmetallic mineral	52	7,876,213	3	139	142	31,075	18.029	3945.424
Total	189	73,303,957	51	1,656	1,707	454,701	23.287	6202.953
Open-pit	96	24,215,582	7	201	208	53,109	8.590	2193.175
Quarries	334	27,987,913	8	375	383	72,752	13.684	2599.408
Grand total	619	125,507,452	66	2,232	2,298	580,562	18.310	4625.717

THE 33-YEAR HISTORY OF THE NATIONAL SAFETY COMPETITION

1925-1957

Type of mine	*Man-hours*	*Fatal injuries*	*Nonfatal injuries*	*Total*	*Days of disability*	*Frequency rate*	*Severity rate*
Anthracite	665,828,403	784	58,076	58,860	6,965,877	88.401	10461.970
Bituminous-coal	1,539,160,703	1,488	61,982	63,470	14,064,079	41.237	9137.499
Metal	606,946,999	462	20,752	21,214	4,069,532	34.952	6704.922
Nonmetallic mineral	162,482,547	93	4,323	4,416	832,277	27.178	5122.255
Total	2,974,418,652	2,827	145,133	147,960	25,931,765	49.744	8718.263
Open-pit	399,338,208	109	6,002	6,111	1,054,225	15.303	2639.930
Quarries	578,032,092	264	10,416	10,680	2,406,232	18.476	4162.800
Grand total	3,951,788,952	3,200	161,551	164,751	29,392,222	41.690	7437.700

tuminous-coal group was 6,280.6 (per million man-hours) in 1957, as compared with the 1956 group rate of 6,938.6.

Metal Mines

For the second time the Calloway-Mary Mine of the Tennessee Copper Company, Copperhill, Polk County, Tennessee, has received the Sentinels of Safety trophy for the best safety record submitted among the underground metal mines enrolled in the contest. This mine was operated in 1957 without a lost-time injury during the 219,085 man-hours worked.

The Calloway-Mary Mine, in its 14 consecutive years of participation, was awarded the trophy in 1953 and received honorable mention in 1945, 1946, 1948, 1949, and 1952 for an injury-free record.

The 58 underground metal mines enrolled in the 1957 competition oper-

BELLEFONTE MINE EMPLOYES: These are the men of the Bellefonte Mine of National Gypsum Company who made the best record among the nonmetallic operations enrolled in the 1957 competition. This property also won the trophy in 1949.

SURFACE BUILDINGS: This view of some of the surface facilities at the Bellefonte Mine, Bellefonte, Centre County, Pennsylvania, includes the crushers, kilns, repair shops, and offices.

ated 23,178,147 man-hours. The injury-severity rate for this time is 5,641.0 days charged per million man-hours, while the rate for 1956 was 6,531.0. The 1957 injury-frequency rate for the metal-mine group is 29.99 days per million man-hours, as compared with 28.79 days in the 1956 competition.

Nonmetallic Mines

The winning contestant among the underground mines producing nonmetallic minerals is the Bellefonte Limestone Mine of the National Gypsum Company, Bellefonte, Centre County, Pennsylvania, which worked a total of 313,925 man-hours without sustaining a lost-time injury to its workers.

The Bellefonte Mine has been a contestant for nine consecutive years and was successful in winning the Sentinels of Safety trophy once before in 1949. During the nine years of competition, this mine has reported a total of 2,806,932 man-hours worked and

MISSISSIPPI GROUP MINERS: Shown here are some of the pit and shop employes at the Mississippi Group Mine operated by the M. A. Hanna Company. This mine was the winner in the open-pit group with 628,549 man-hours worked without a disabling injury.

THE OPEN PIT: A view of the open-pit operations of M. A. Hanna's Mississippi Group Mine located near Keewatin on the Mesabi Range in Minnesota. The iron ore mined here is delivered to a benefication plant for upgrading before shipment to the ore docks at Superior, Wisconsin.

AIR VIEW OF CALCITE: This bird's-eye view of the Calcite plant of Michigan Limestone Division of U. S. Steel Company shows the complete mill facilities, storage piles, and the loading docks. This quarry placed first in the quarry division of the 1957 National Safety Competition.

17 disabling injuries incurred (including 1 fatality), which resulted in a severity rate of 2,376.6 days per million man-hours and a frequency rate of 6.06 disabling injuries per million man-hours of exposure.

The 52 entries in the class of underground nonmetallic mines recorded an injury-frequency rate of 18.03 per million man-hours during 1957, as compared with 20.47 the previous year. The 1957 injury-severity rate of 3,945.4 days charged per million man-hours is not so favorable as the 1956 rate of 2,862.3. This group reported a total exposure of nearly 8 million man-hours in 1957, with 142 disabling injuries, three of which were fatalities.

Open-pit Mines

The 1957 Sentinels of Safety trophy for the group of open-pit mines was won by the Mississippi Group Mine of The M. A. Hanna Company (Hanna Ore Mining Company), Keewatin, Itasca County, Minnesota. The mine worked 628,549 man-hours without a disabling injury. In 1954 the Mississippi Group Mine received honorable mention for its injury-free record. During 16 years in the competition, this open-pit mine has operated 8½ million man-hours with an injury-severity rate of 2,537.5 days charged per million man-hours. For the same period the injury-frequency rate is 10.88 per million man-hours.

Ninety-six open-pit mines participated in the 1957 contest, nine more than in 1956. These mines worked over 24 million man-hours in 1957. Their injury-severity rate for the year was 2,193.2 days, and they had an injury-frequency rate of 8.59 per million man-hours. These rates compare favorably with the 33-year average injury-severity rate of 2,639.9 per million man-hours and the injury-frequency rate of 15.30 per million man-hours of exposure to the hazards of open-pit mining.

Quarries

A continuous 30-year participant in the National Safety Competition won the Sentinels of Safety trophy in the quarry group for the sixth time in 1957. The Calcite Quarry of Michigan Limestone Division of United States Steel Corporation, Rogers City, Presque Isle County, Michigan, worked the outstanding total of 1,142,423 man-hours without a disabling injury. During the 30 years in which this quarry participated in the competition it worked a total of more than 30½ million man-

hours, and had 45 disabling work injuries, with an injury-frequency rate of 1.46 per million man-hours. This quarry was the trophy winner in 1929, 1932, 1933, 1934, and 1950.

A total of 334 quarries (91 more than in 1956) enrolled in the 1957 National Safety Competition, the largest enrollment in the quarry group in the history of the competition.

As a group, the 334 quarries had a favorable safety record. The injury-severity rate of 2,599.4 days per million man-hours is lower than the rate of 3,431.3 established in 1956. Although the injury-frequency rate of 13.68 was slightly higher than that of the previous year, it was considerably better than the 33-year average injury-frequency rate of 18.48 days charged per million man-hours.

Rules of the Competition

All mines and quarries in the United States are eligible to enter the National Safety Competition. To compete for the Sentinels of Safety trophy, however, a mine or quarry must have been operated a minimum of 100 days and to have had a total worktime of not less than 30,000 man-hours in underground, pit, or quarry operations during the contest year. A designated official at each plant has to furnish a report of each lost-time injury and certain employment data to the Bureau of Mines.

An injury that causes a temporary total disability is charged with the number of calendar days the injured employe is unable to work; this number includes Sundays, holidays, and all other days, whether or not the mine or the quarry was idle or active.

Accidents resulting in death or permanent total disability are charged with 6,000 days. For permanent partial disabilities, such as the loss of an eye or finger, or the loss of the function of any part of the body, the charge is such part of 6,000 days as the partial disability bears to the total and permanent destruction of the employe's ability to work. The various charges for permanent partial disabilities are listed in the detailed set of rules sent to each enrolling plant.

Application forms for enrollment in the National Safety Competition and copies of the contest rules may be obtained from the U. S. Department of the Interior, Bureau of Mines, Branch of Accident Analysis, Division of Safety, Washington 25, D. C.

THE SCREEN HOUSE: Towering 12 stories high, the screen house at Calcite is the tallest structure in Rogers City. In the background may be seen storage piles of various sizes of stone produced at the Calcite Quarry and the intricate conveyor system.

ALL-TIME WINNERS

ANTHRACITE

1925—Hazle Brook Coal Company, *Upper Lehigh Mine*, Upper Lehigh, Pa.

1926—Jeddo-Highland Coal Company, *Highland No. 6 Mine*, Jeddo, Pa.

1927—Jeddo-Highland Coal Company, *Highland No. 6 Mine*, Jeddo, Pa.

1928—Jeddo-Highland Coal Company, *Highland No. 7 Mine*, Jeddo, Pa.

1929—Jeddo-Highland Coal Company, *Highland No. 6 Mine*, Jeddo, Pa.

1930—Coxe Brothers & Company, Inc., *Tomhicken Mine*, Jeddo, Pa.

1931—Jeddo-Highland Coal Company, *Highland No. 2 Mine*, Jeddo, Pa.

1932—Jeddo-Highland Coal Company, *Highland No. 7 Mine*, Jeddo, Pa.

1933—The Hudson Coal Company, *Stillwater Mine*, Vandling, Pa.

1934—Harleigh-Brookwood Coal Company, *Laurence Mine*, Mahanoy Plane, Pa.

1935—Jeddo-Highland Coal Company, *Jeddo No. 7 Mine*, Harleigh, Pa.

1936—Hazle Brook Coal Company, *Raven Run Mine*, Raven Run, Pa.

1937—Jeddo-Highland Coal Company, *Jeddo No. 7 Mine*, Harleigh, Pa.

1938—Colonial Colliery Company, *Greenough Mine*, Natalie, Pa.

1939—The Hudson Coal Company, *Eddy Creek Mine*, Olyphant, Pa.

1940—Hazle Brook Coal Company, *Midvalley Mine*, Wilburton, Pa.

1941—Eddie & Joe Coal Company, *Eddie & Joe Mine*, Simpson, Pa.

1942—Jeddo-Highland Coal Company, *Stockton Mine*, Stockton, Pa.

1943—Morgan Coal Mine, *Oregon Slope Mine*, Pittston, Pa.

1944—The Hudson Coal Company, *Miles Slope Mine*, Dickson City, Pa.

1945—Jermyn-Green Coal Company, *Butler Mine*, Pittston, Pa.

1946—Jermyn-Green Coal Company, *Butler Mine*, Pittston, Pa.

1947—Jermyn-Green Coal Company, *Butler Mine*, Pittston, Pa.

1948—Philadelphia and Reading Coal and Iron Company, *Hunter Tunnel Mine*, Ashland, Pa.

1949—Kehoe-Berge Coal Company, *Stevens Shaft Mine*, Exeter, Pa.

1950—The Hudson Coal Company, *Birdseye Mine*, Throop, Pa.

1951—Ploskonka Coal Company, *No. 5 Hill Mine*, Archbald, Pa.

1952—Philadelphia and Reading Coal and Iron Company, *Hunter Tunnel Mine*, Ashland, Pa.

1953—The Hudson Coal Company, *Coal Brook Mine*, Carbondale, Pa.

1954—Ploskonka Coal Company, *No. 5 Hill Mine*, Archbald, Pa.

1955—Raven Run Coal Company, *Germantown Colliery*, Centralia, Pa.

1956—Penag Coal Company, *Goodspring Mine*, Goodspring, Pa.

1957—Reading Anthracite Company, *Pine Knot Colliery*, Minersville, Pa.

BITUMINOUS-COAL

1925—United States Coal and Coke Company, *No. 6 Mine*, Gary, W. Va.

1926—United States Coal and Coke Company, *No. 6 Mine*, Gary, W. Va.

1927—United States Coal and Coke Company, *No. 2 Mine*, Gary, W. Va.

1928—United States Coal and Coke Company, *No. 4 Mine*, Gary, W. Va.

1929—DeBardeleben Coal Corporation, *Hull No. 33 Mine*, Dora, Ala.

1930—Penn Central Light and Power Company, *No. 1 Mine*, Coalmont, Pa.

1931—Phelps-Dodge Corporation, *Dawson No. 1 Mine*, Dawson, N. Mex.

1932—Electro Metallurgical Company, Alloy, W. Va.

1933—The Union Pacific Coal Company, *"B" Mine*, Superior, Wyo.

1934—The Union Pacific Coal Company, *"C" Mine*, Superior, Wyo.

1935—Elkhorn Piney Coal Company, *Ingram Branch Mine*, Ingram Branch, W. Va.

1936—The Koppers Coal Company, *Coxton Mine*, Coxton, Ky.

1937—The Union Pacific Coal Company, *"D" Mine*, Superior, Wyo.

1938—The Union Pacific Coal Company, *"B" Mine*, Superior, Wyo.

1939—The Union Pacific Coal Company, *Winton No. 1 Mine*, Winton, Wyo.

1940—The Union Pacific Coal Company, *Rock Springs No. 4 Mine*, Rock Springs, Wyo.

1941—Electro Metallurgical Company, *Alloy No. 2 Mine*, Alloy, W. Va.

1942—Knife River Coal Company, *Knife River Mine*, Beulah, N. Dak.

1943—The Union Pacific Coal Company, *"D" Mine*, Superior, Wyo.

1944—The Union Pacific Coal Company, *"D" Mine*, Superior, Wyo.

1945—Rockhill Coal Company, *Rockhill No. 5 Mine*, Robertsdale, Pa.

1946—Consolidated Coal Company, *Bankhead No. 2 Mine*, Bankhead, Ala.

1947—The Union Pacific Coal Company, *Winton No. 1 and 7½ Mine*, Winton, Wyo.

1948—The Union Pacific Coal Company, *Reliance No. 7 Mine*, Reliance, Wyo.

1949—The Union Pacific Coal Company, *Reliance No. 7 Mine*, Reliance, Wyo.

1950—The Union Pacific Coal Company, *Reliance No. 7 Mine*, Reliance, Wyo.

1951—The Union Pacific Coal Company, *Reliance No. 7 Mine*, Reliance, Wyo.

1952—Tennessee Coal and Iron Division, United States Steel Corporation, *Short Creek Mine*, Adamsville, Ala.

1953—The Union Pacific Coal Company, *Hanna No. 4-A Mine*, Hanna, Wyo.

1954—Alabama By-Products Corporation, *Labuco Mine*, Flat Creek, Ala.

1955—Alabama By-Products Corporation, *Labuco Mine*, Flat Creek, Ala.

1956—Tennessee Coal and Iron Division, United States Steel Corporation, *Edgewater Mine*, Wylam, Ala.

1957—Republic Steel Corporation, *Republic Mine*, Elkhorn City, Ky.

METAL

1925—New York Mining Company, *New York Mine (zinc and lead)*, Picher, Okla.

1926—Federal Mining and Smelting Company, *Muncie Mine (zinc and lead)*, Baxter Springs, Kans.

1927—The Bristol Mining Company, *Bristol Mine (iron)*, Crystal Falls, Mich.

1928—Brule Mining Company, *Berkshire Mine (iron)*, Stambaugh, Mich.

1929—Brule Mining Company, *Berkshire Mine (iron)*, Stambaugh, Mich.

1930—Penn Iron Mining Company, *West Vulcan Mine*, Vulcan, Mich.

1931—Hanna Ore Mining Company, *Harold Mine*, Carson Lake, Minn.

1932—St. Joseph Lead Company, *Balmat Mine (lead, zinc, and pyrites)*, Balmat, N. Y.

1933—Tennessee Copper Company, *Burra Burra Mine*, Ducktown, Tenn.

1934—Penn Iron Mining Company, *East Vulcan Mine*, Vulcan, Mich.

1935—Vermillion Mining Company, *Zenith Mine (iron)*, Ely, Minn.

1936—Penn Iron Mining Company, *East Vulcan Mine*, Vulcan, Mich.

1937—M. A. Hanna Company, *Hiawatha No. 1 Mine (iron)*, Iron River, Mich.

1938—Odanah Iron Company, *Cary Mine (iron)*, Hurley, Wis.

1939—M. A. Hanna Company, *Bates Mine (iron)*, Iron River, Mich.

1940—Phelps-Dodge Corporation, *Humboldt Mine*, Morenci, Ariz.

1941—American Zinc Company of Tennessee, *Grasselli Mine (zinc sulphide)*, New Market, Tenn.

1942—Tennessee Copper Company, *Boyd Mine*, Ducktown, Tenn.

1943—Penn Iron Mining Company, *East Vulcan Mine*, Vulcan, Mich.

1944—Youngstown Mines Corporation, *Newport Mine (iron)*, Ironwood, Mich.

1945—James Mining Company, *James Mine (iron)*, Iron River, Mich.

1946—Tennessee Copper Company, *Burra Burra Copper Mine*, Ducktown, Tenn.

1947—Oliver Iron Mining Company, *Soudan Mine*, Soudan, Minn.

1948—Oliver Iron Mining Company, *Fraser Mine*, Fraser, Minn.

1949—American Zinc Company of Tennessee, *No. 2 Mine*, Mascot, Tenn.

1950—Republic Steel Corporation, *Tobin Mine*, Crystal Falls, Mich.

1951—Oliver Iron Mining Company, *Soudan Mine*, Soudan, Minn.

1952—The Verona Mining Company, Pickands Mather & Company, *Buck Mine*, Caspian, Mich.

1953—Tennessee Copper Company, *Calloway-Mary Mine*, Ducktown, Tenn.

1954—Pickands Mather & Company, *Zenith Mine*, Ely, Minn.

1955—Pickands Mather & Company, *Zenith Mine*, Ely, Minn.

1956—Pickands Mather & Company, *Buck Mine*, Caspian, Mich.

1957—Tennessee Copper Company, *Calloway-Mary Mine*, Copperhill, Tenn.

NONMETALLIC

1925—United States Gypsum Company, *Lower Gypsum Mine*, Gypsum, Ohio.

1926—The Beaver Products Company, Inc., *Grand Rapids Mine (gypsum)*, Grand Rapids, Mich.

1927—The Marquette Cement Manufacturing Company, *La Salle Mine (limestone)*, Oglesby, Ill.

1928—Alpha Portland Cement Company, *Ironton Mine (limestone)*, Ironton, Ohio.

1929—Retsof Mining Company, *Retsof Mine (rock salt)*, Retsof, N. Y.

1930—United States Gypsum Company, *Lower Gypsum Mine*, Gypsum, Ohio.

1931—Retsof Mining Company, *Retsof Mine (rock salt)*, Retsof, N. Y.

1932—Retsof Mining Company, *Retsof Mine (rock salt)*, Retsof, N. Y.

1933—Retsof Mining Company, *Retsof Mine (rock salt)*, Retsof, N. Y.

1934—The Marquette Cement Manufacturing Company, *La Salle Mine (limestone)*, Oglesby, Ill.

1935—Certain-teed Products Corporation, *Gypsum Mine*, Akron, N. Y.

1936—Tennessee Coal, Iron & Railroad Company, *No. 5 Mine (limestone)*, Bessemer, Ala.

1937—Tennessee Coal, Iron & Railroad Company, *No. 5 Mine (limestone)*, Bessemer, Ala.

1938—Avery Salt Company, Avery Island, La.

1939—Tennessee Coal, Iron & Railroad Company, *No. 5 Mine (limestone)*, Bessemer, Ala.

1940—Tennessee Coal, Iron & Railroad Company, *No. 5 Mine (limestone)*, Bessemer, Ala.

1941—The United States Gypsum Company, *No. 6 Mine (gypsum)*, Plasterco, Va.

1942—Alpha Portland Cement Company, *Ironton Mine (limestone)*, Ironton, Ohio.

1943—United States Gypsum Company, *No. 6 Mine (gypsum)*, Plasterco, Va.

1944—National Gypsum Company, *Akron Gypsum Mine*, Akron, N. Y.

1945—Freeport Brick Company, *Freeport Mine (clay)*, Freeport, Pa.

1946—Certain-teed Products Corporation, *Acme Gypsum Mine*, Acme, Texas.

1947—Tennessee Coal, Iron & Railroad Company, *No. 5 Mine (limestone)*, Bessemer, Ala.

1948—Alpha Portland Cement Company, *Ironton Mine*, Ironton, Ohio.

1949—National Gypsum Company, *Bellefonte Mine*, Bellefonte, Pa.

1950—Pittsburgh Plate Glass Company, *Barberton Limestone Mine*, Barberton, Ohio.

1951—International Salt Company, *Retsof Mine*, Retsof, N. Y.

1952—Michigan Limestone Division, United States Steel Corporation, *Annandale Mine (limestone)*, Boyers, Pa.

1953—Michigan Limestone Division, United States Steel Corporation, *Annandale Mine (limestone)*, Boyers, Pa.

1954—United States Gypsum Company, *No. 6 Mine (gypsum)*, Plasterco, Va.

1955—Warner Company, *Bell Mine*, Bellefonte, Pa.

1956—Warner Company, *Bell Mine*, Bellefonte, Pa.

1957—National Gypsum Company, *Bellefonte Mine*, Bellefonte, Pa.

OPEN-PIT AND QUARRIES

1925—North American Cement Corporation, *Security Quarry (limestone)*, Security, Md.

1926—North American Cement Corporation, *No. 5 and 6 Quarry (limestone)*, Martinsburg, W. Va.

1927—Lehigh Portland Cement Company, *Mitchell Quarry (limestone)*, Mitchell, Ind.

1928—Wakefield Iron Company, *Wakefield Open-pit Mine (iron)*, Wakefield, Mich.

1929—Michigan Limestone & Chemical Company, *Rogers City Quarry (limestone)*, Rogers City, Mich.

1930—Plymouth Mining Company, *Plymouth Open-pit (iron)*, Wakefield, Mich.

1931—Mahoning Ore & Steel Company, *Mahoning Open-pit Mine (iron)*, Hibbing, Minn.

1932—Michigan Limestone & Chemical Company, *Rogers City Quarry (limestone)*, Rogers City, Mich.

1933—Michigan Limestone & Chemical Company, *Rogers City Quarry (limestone)*, Rogers City, Mich.

1934—Michigan Limestone & Chemical Company, *Rogers City Quarry (limestone)*, Rogers City, Mich.

1935—Folsom State Prison, *Granite Quarry*, Folsom, Calif.

1936—Hanna Ore Mining Company, *Mesabi Chief Mine (iron)*, Keewatin, Minn.

1937—Illinois State Penitentiary, *Limestone Quarry*, Menard, Ill. (Separated into Individual Groups in 1938.)

OPEN-PIT

1938—Pickands Mather & Company, *Mahoning Mine (iron-ore)*, Hibbing, Minn.

1939—Pickands Mather & Company, *Scranton Mine (iron-ore)*, Hibbing, Minn.

1940—Pickands Mather & Company, *Mahoning Mine (iron-ore)*, Hibbing, Minn.

1941—Pickands Mather & Company, *Mahoning Mine (iron-ore)*, Hibbing, Minn.

1942—Pickands Mather & Company, *Mahoning Mine*, Hibbing, Minn.

1943—Pickands Mather & Company, *Danube Mine*, Bovey, Minn.

1944—Pickands Mather & Company, *Danube Mine*, Bovey, Minn.

1945—Pickands Mather & Company, *Mahoning Mine*, Hibbing, Minn.

1946—Oliver Iron Mining Company, *Rouchleau Iron-ore Pit*, Virginia, Minn.

1947—Pickands Mather & Company, *Mahoning Mine*, Hibbing, Minn.

1948—Oliver Iron Mining Company, *Spruce Open-cut Mine*, Eveleth, Minn.

1949—Pickands Mather & Company, *Embarrass Mine*, Biwabik, Minn.

1950—Pickands Mather & Company, *Embarrass Mine*, Biwabik, Minn.

1951—Oliver Iron Mining Company, *Mt. Iron Mine*, Mt. Iron, Minn.

1952—International Minerals and Chemical Corporation, *Noralyn Mine*, Bartow, Fla.

1953—Pickands Mather & Company, *Mahoning Mine*, Hibbing, Minn.

1954—Pickands Mather & Company, *Mahoning Mine*, Hibbing, Minn.

1955—Pickands Mather & Company, *Erie Commercial Mine*, Aurora, Minn.

1956—Pickands Mather & Company, *Embarrass Mine*, Biwabik, Minn.

1957—Hanna Ore Mining Company, *Mississippi Group Mine*, Keewatin, Minn.

QUARRIES

1938—Inland Lime & Stone Company, *Port Inland Quarry (limestone)*, Manistique, Mich.

1939—Inland Lime & Stone Company, *Port Inland Quarry (limestone)*, Manistique, Mich.

1940—Tennessee Coal, Iron & Railroad Company, *Dolonah Quarry (dolomite)*, Bessemer, Ala.

1941—Tennessee Coal, Iron & Railroad Company, *Dolonah Quarry (dolomite)*, Bessemer, Ala.

1942—Bethlehem Steel Company, *Hanover Quarry*, Hanover, Pa.

1943—Wyandotte Chemicals Corporation, *Alpena Quarry*, Alpena, Mich.

1944—Basic Refractories, Inc., *Maple Grove Quarry (dolomite)*, Maple Grove, Ohio.

1945—Bethlehem Steel Company, *Bridgeport Quarry (limestone)*, Bridgeport, Pa.

1946—Bethlehem Steel Company, *Bridgeport Quarry (limestone)*, Bridgeport, Pa.

1947—Tennessee Coal, Iron & Railroad Company, *Dolonah Quarry (dolomite)*, Bessemer Ala.

1948—Bethlehem Steel Company, *Hanover Quarry*, Hanover, Pa.

1949—Tennessee Coal, Iron & Railroad Company, *Dolonah Quarry (dolomite)*, Bessemer, Ala.

1950—Michigan Limestone & Chemical Company, *Rogers City Quarry (limestone)*, Rogers City, Mich.

1951—Inland Lime & Stone Company, *Port Inland Quarry (limestone)*, Gulliver, Mich.

1952—Michigan Limestone Division, United States Steel Corporation, *Hillsville Quarry (limestone)*, Hillsville, Pa.

1953—Wyandotte Chemicals Corporation, *Alpena Quarry*, Alpena, Mich.

1954—Material Service Corporation, *Thornton Quarry (limestone)*, Thornton, Ill.

1955—United States Steel Corporation, *Hillsville Limestone Quarry*, Hillsville, Pa.

1956—Wyandotte Chemicals Corporation, *Alpena Quarry*, Alpena, Mich.

1957—United States Steel Corporation, *Calcite Quarry*, Rogers City, Mich.

Awards of Certificates of Achievement in Safety—1957

Rules of the competition provide for the award of Certificates of Achievement in Safety to each mine or quarry, other than the trophy winners, whose position in the contest was among the first four in its respective group. These mines and quarries are listed below.

Certificates are also awarded each injury-free mine or quarry that worked 30,000 or more man-hours during the 12 consecutive months of each contest. We regret that space limitations do not permit listing all of the recipients.

ANTHRACITE MINES

No. 3 Slope of Stockton Mine, Stockton, Luzerne County, Pa., operated by the Jeddo-Highland Coal Company. Worked 153,992 man-hours with 15 lost-time injuries causing 305 days of disability. Injury-severity rate was 1,980.6.

Eddy Creek Shaft Mine, Olyphant, Lackawanna County, Pa., operated by The Hudson Coal Company. Worked 305,195 man-hours with 34 lost-time injuries causing 659 days of disability. Injury-severity rate was 2,159.3.

Olyphant Shaft Mine, Olyphant, Lackawanna County, Pa., operated by The Hudson Coal Company. Worked 394,850 man-hours with 40 lost-time injuries causing 1,061 days of disability. Injury-severity rate was 2,687.1.

Loree No. 3 Mine, Plymouth, Luzerne County, Pa., operated by The Hudson Coal Company. Worked 543,586 man-hours with 40 lost-time injuries causing 1,686 days of disability. Injury-severity rate was 3,101.6.

BITUMINOUS-COAL MINES

Rock Springs No. 8 Mine, Rock Springs, Sweetwater County, Wyo., operated by the Union Pacific Coal Company. Worked 72,097 man-hours without a lost-time injury.

Bell Creek Mine, Cedar Grove, Kanawha County, W. Va., operated by the Electro Metallurgical Company, Division of Union Carbide and Carbon Corporation. Worked 71,171 man-hours without a lost-time injury.

Patton Clay Mine No. 1, Patton, Cambria County, Pa., operated by the Patton Clay Manufacturing Company. Worked 32,719 man-hours without a lost-time injury.

Alloy No. 2 Gas Mine, Alloy, Fayette County, W. Va., operated by the Electro Metallurgical Company, Division of Union Carbide and Carbon Corporation. Worked 32,486 man-hours without a lost-time injury.

METAL MINES

Boyd Mine, Ducktown, Polk County, Tenn., operated by the Tennessee Copper Company. Worked 205,524 man-hours without a lost-time injury.

Wenonah No. 9 Mine, Bessemer, Jefferson County, Ala., operated by the Tennessee Coal and Iron Division of United States Steel Corporation. Worked 383,834 man-hours with 1 lost-time injury causing 23 days of disability. Injury-severity rate was 59.9.

Sunday Lake Mine, Wakefield, Gogebic County, Mich., operated by Pickands Mather & Company (The Sunday Lake Iron Company). Worked 522,926 man-hours with 2 lost-time injuries causing 36 days of disability. Injury-severity rate was 68.8.

Sherwood Mine, Iron River, Iron County, Mich., operated by the Inland Steel Company. Worked 180,114 man-hours with 1 lost-time injury causing 15 days of disability. Injury-severity rate was 83.3.

NONMETALLIC MINES

Kimballton Mine, Kimballton, Giles County, Va., operated by the National Gypsum Company. Worked 213,030 man-hours without a lost-time injury.

Valmeyer No. 3 Limestone Mine, Valmeyer, Monroe County, Ill., operated by the Columbia Quarry Company. Worked 211,470 man-hours without a lost-time injury.

Kaylor Limestone Mine, Kaylor, Armstrong County, Pa., operated by Michigan Limestone Division of United States Steel Corporation. Worked 205,944 man-hours without a lost-time injury.

Pleasant Gap Mine, Pleasant Gap, Centre County, Pa., operated by the Standard Lime and Cement Company. Worked 154,728 man-hours without a lost-time injury.

OPEN-PIT MINES

Hull-Rust Mine, Hibbing, St. Louis County, Minn., operated by Oliver Iron Mining Division of United States Steel Corporation. Worked 488,476 man-hours without a lost-time injury.

Sydney Mine, Sydney, Hillsborough County, Fla., operated by the American Cyanamid Company. Worked 337,536 man-hours without a lost-time injury.

Embarrass Mine, Biwabik, St. Louis County, Minn., operated by Pickands Mather & Company (Lake Mining Company). Worked 322,279 man-hours without a lost-time injury.

Portsmouth Mine, Crosby, Crow Wing County, Minn., operated by Hanna Iron Ore Division of National Steel Corporation. Worked 300,582 man-hours without a lost-time injury.

QUARRIES

Clinton Point Quarry, New Hamburg, Dutchess County, N. Y., operated by the New York Trap Rock Corporation. Worked 374,800 man-hours without a lost-time injury.

Hillsville Quarry, New Castle, Lawrence County, Pa., operated by the Michigan Limestone Division of United States Steel Corporation. Worked 369,675 man-hours without a lost-time injury.

Cedarville Quarry, St. Ignace, Mackinac County, Mich., operated by the Michigan Limestone Division of United States Steel Corporation. Worked 312,374 man-hours without a lost-time injury.

Hanover Quarry, Hanover, York County, Pa., operated by the Bethlehem Limestone Company. Worked 302,478 man-hours without a lost-time injury.

Driving the Sandy Ridge Tunnel

A new 8,240-ft.-long tunnel under construction in Virginia will make available an untapped source of high-grade coal for generating plants, steel mills, and export

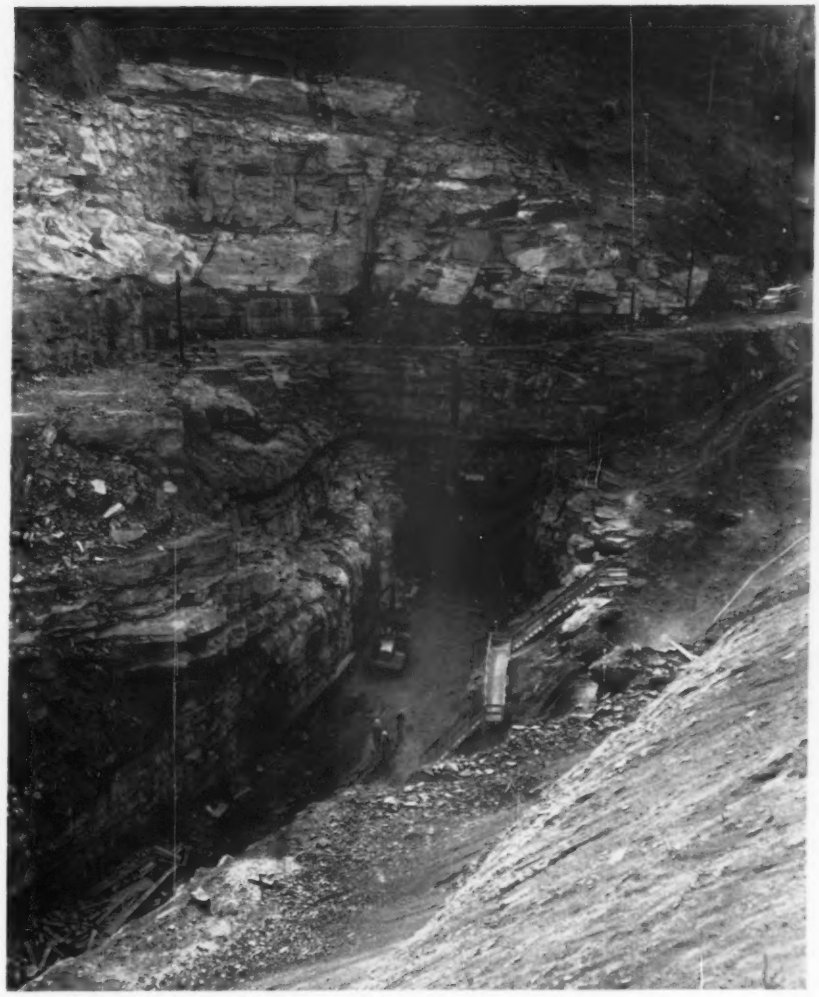
W. R. HUBBLE*

DOWN in the southwest corner of Virginia, where the point of the state separates Kentucky from Tennessee, three progressive organizations—the Norfolk and Western Railway Company, the Clinchfield Coal Company (division of The Pittston Company), and the Appalachian Electric Power Company—are each engaged in huge expansion programs. These extensive programs are independent, but are to a great extent interrelated.

This section of Virginia, particularly Russell and Dickenson Counties, is noted for its high-grade bituminous-coal deposits. Here are located the headquarters of the extensive operations of the Clinchfield Coal Company. This rich coal field produces a fuel suited for the manufacture of steam and another that is excellent for metallurgical uses where a premium fuel is required. Other fuels mined are suitable for special- and general-use coal, and for domestic and power plant uses. The quality of the coal mined in this area has been so widely accepted that Clinchfield Coal Company has been engaged in a constant expansion program, opening new mines and erecting several large coal-preparation plants.

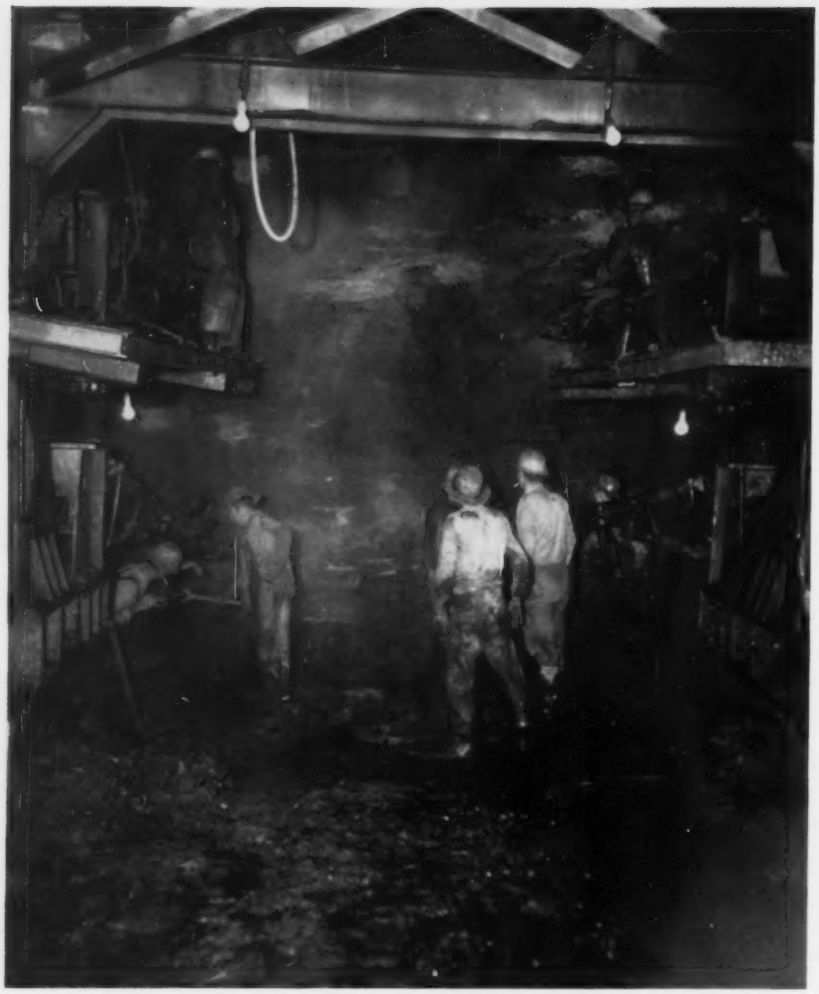
Expansion Plans

The latest move in the Clinchfield expansion plans is the erection of a large preparation plant near Carbo.



NORTH PORTAL: Because of the great difference in elevation of the land on the two sides of the mountain and the desire to avoid excessive track grade, the approach to the north portal required a 156-ft. cut.

*Hercules Powder Company
Pittsburgh, Pennsylvania



WORKING FROM A JUMBO: A jumbo consisted of two main platforms plus a small auxiliary platform for drilling holes in the arched roof. Nine drills were operated from each jumbo. Mounted on flanged wheels, the jumbos were pulled down the tunnel before blasting.

This plant, known as the Moss No. 3 Preparation Plant, will be able to clean and blend the various types and grades of coal it will receive from the many Clinchfield mines in the area. Initial capacity of the new preparation plant will be about 15,000 tons of clean coal daily, although this may ultimately be expanded to 30,000 tons a day.

It was only natural that the rich coal deposits, so suited for steam plants and the generating of electricity, would attract the attention of officials of the Appalachian Electric Power Company. The power company is erecting one of its generating plants at Carbo at a cost of about $55 million. The coal-burning steam plant, the Clinch River Plant, will produce electric power for a large area and will, when running at capacity, be capable of producing 450,000 kw.

The Norfolk and Western Railway's part of the area's expansion activities is the extension, 6.3 miles long, of its Wilder Spur line, which serves the Clinchfield properties. The extension included the driving of a single-track railway tunnel, to be known as the Sandy Ridge Tunnel. The Wilder Spur will then be able to serve the new coal properties being opened by Clinchfield in Dickenson County, particularly Moss No. 3 mines near Duty. Two mine spurs, with a combined length of 3.5 miles, will serve these mines.

The Sandy Ridge Tunnel

The Sandy Ridge Tunnel, designed by the engineering staff of the N & W, will be 8,240 ft. long when completed. It will be the longest tunnel in the Norfolk and Western system and one of the longest in the East. The contract for the construction of the approaches and the tunnel was awarded to the Ralph E. Mills Company of Frankfort, Kentucky. Some of the major jobs completed by the Mills organization have been road construction in Costa Rica, Puerto Rico's International Airport, and two sections of the West Virginia Turnpike.

Sandy Ridge Tunnel will be an archtype single-track tunnel. It will have an unfinished width of 20 ft. at the base and will be about 27 ft. high at the peak of the arch. When lined with concrete, the dimensions will be reduced to 17 ft. wide at springing line and 23 ft. high above the base of the rail at the center of the arch.

Before any actual tunnel construction was started, test borings were drilled from the top of the mountain at five widely separated locations along the route of the tunnel. The borings were drilled to a depth of 17 to 20 ft. below the proposed floor level. Test boring was done by Cunningham Core Drill and Grouting Company of Salem, Virginia. The core taken from the hole drilled at a point of 2,435-ft. elevation could be considered typical of the strata through which the tunnel was to be driven. After penetrating 32 ft. of earth and boulders, the core revealed layers of shale, coal, and sandstone of varying thicknesses and in no order of appearance. Some layers of shale were as thick as 83 ft. while other layers were as thin as 2½ ft. The sandstone varied from a maximum of 56 ft. to a minimum of 18½ ft. The thickest layer of coal encountered was 4 ft.

The Jumbos

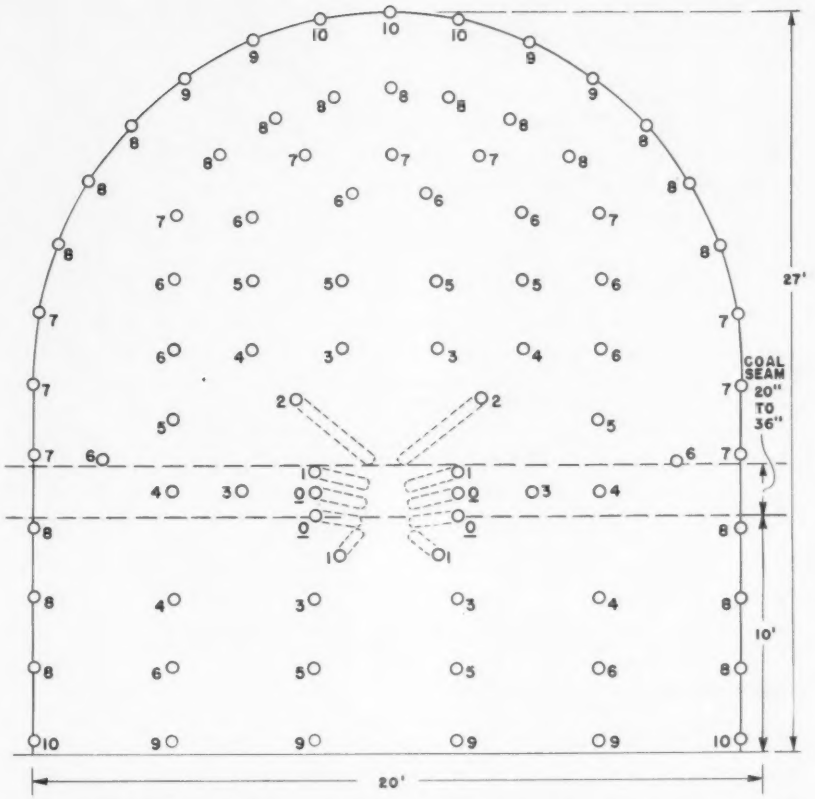
The jumbos from which the tunnel rounds were drilled were specially designed by the engineers of Rish Equipment Company of Roanoke, Virginia, working in conjunction with the engineers of the N & W and the Mills company. The design of the jumbos was based on experience gained by this group in previous tunnel jobs and modified to meet the requirements of working in the Sandy Ridge Tunnel. Each jumbo consisted of two main platforms plus a small auxiliary plat-

form on the top to take care of drilling of the holes in the arched roof. The jumbos were mounted on flanged wheels that ran on a rail track for ease of movement. An Allis-Chalmers HD-20 pulls the jumbos down the tunnel heading before blasts are fired. Set on each jumbo, one in each heading, are nine Ingersoll-Rand drifters mounted on pneumatically operated booms. With the jumbos thus equipped, it is possible to work two shifts of ten hours each, and to pull approximately 11 ft. of tunnel per shift. The constant flow of compressed air required for the drills is supplied by ten (five at each portal) Gardner-Denver compressors, each capable of producing 500 cu. ft. of air per minute. The air is delivered to the working face through a 6-in. metal pipe fastened to the side of the tunnel.

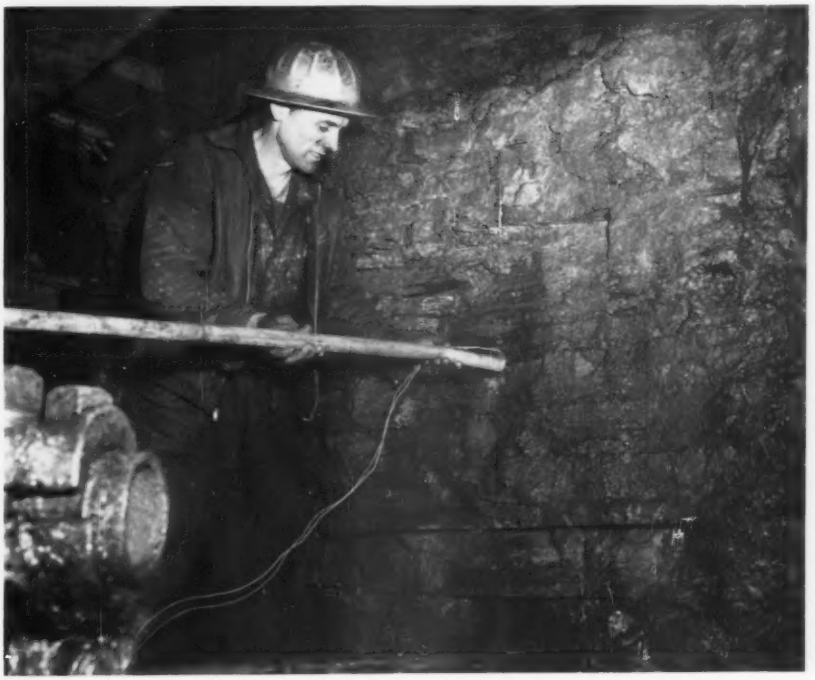
Drilling Round

The rounds for blasting in the tunnel varied slightly, depending on how the rock lay. A typical round in the 20 by 27-ft. heading consists of 90 holes 1¾ in. in diameter, each 12 ft. in depth, using a wedge type of cut. A diagram of this round is shown at the right. Timken 1¾-in. detachable bits gave excellent service in drilling through the sandstone, the primary material encountered in the tunnel. No excessive bit wear was experienced. The used drill bits are taken to the bit-sharpening unit located outside the portals for sharpening. A problem in blasting in the tunnel was caused by a 20 to 36-in. coal seam running longitudinally from the top of the section to the bottom and following close to the roof for 4,000 ft. in the tunnel. The rock is first blasted out at the center of the section. This acts as a reliever for the remainder of the round.

The 90-hole round was loaded with 550 lb. of Gelamite® 1, packed in 1¼ by 8-in. cartridges. Each round pulled an average advance of 11 ft. of tunnel, moving 220 cu. yd. of rock. Explosives consumption was 2.5 lb. of Gelamite 1 per solid cubic yard of rock. The first dynamite cartridge placed in the bore hole contained the primer. All holes were loaded out to the collar. Primers were delay electric blasting caps, periods 0 to 10, with 16-ft. plastic-insu-



TYPICAL ROUND: While the rounds varied somewhat, depending upon how the rock lay, the above diagram is typical of the average round. Numerals by the holes in the diagram indicate the period of delay. Each round pulled about 11 ft. of tunnel.



LOADING A ROUND: The round of 90 holes was loaded with 550 lb. of Gelamite 1, packed in 1¼ by 8-in. cartridges. The round was detonated by delay electric blasting caps, periods 0 to 10, and produced approximately 220 cu. yd. of rock.

lated copper leg wires. The wires of the primers were connected in parallel and attached to a buss wire. Using No. 14 insulated copper wire, the blasting circuit is connected to a permanent shooting line tapped into the regular 440-volt power line. Firing is from a safe place—at least 1,000 ft. down the heading. After the men and equipment have been moved to safety zones, the shot firer unlocks the firing switch and detonates the round. The new face, sides, and corners are cut clean. The blasted material is piled high and very little of it is thrown down the tunnel.

Consistently satisfactory fragmentation was secured following this procedure. Water seepage was negligible and there was no delay in drilling or loading because of water.

Mucking Out

As soon as feasible after firing a round in the tunnel, mucking-out operations begin. The latest in earth-moving equipment is being used underground at Sandy Ridge. Two Model 105 Eimcos, one on standby for emergencies, are being used at each heading. When the air clears after a blast, an Eimco loader with a 1½-cu. yd. scoop moves in to do the clean-up work. The Eimco loader keeps nine rubber-tired 5-cu. yd. Koehring Dumptors busy hauling the blasted rock out of the tunnel. Part of the spoil was used as fill for the railway roadbed but most of it was hauled to a dumping area.

The time consumed in drilling is between 1½ and 2 hours, with another hour being used in loading the Gelamite in the drill holes, in connecting up the round, and firing. About 3 hours are needed for the mucking operations, and the remainder of the shift time is spent on scaling and setting the roof bolts and steel supports.

The roof at the north portal was of thin laminated sandstone, which presented serious support problems. Roof bolts were installed as a precautionary measure, in the south heading. Bad roof conditions, in the form of a 20 to 36-in. seam of coal, were encountered for most of the distance excavated from the south end in the south portal. This situation necessitated the installation of steel supports set on an average of 4-ft. centers. The steel supports were fabricated by the Commercial Shearing Company of Cleveland, Ohio, and approximately 4,500,000 lb. of steel were needed for the entire tunnel.

SETTING STEEL: In some sections of the tunnel, bad roof conditions necessitated the installation of steel supports on an average of 4-ft. centers. Approximately 4,500,000 lb. of steel were required for the whole tunnel.

Ventilation

Ventilation, a serious problem in constructing any tunnel, assumed even greater importance in the building of Sandy Ridge. Its greater length combined with the large number of diesel-equipped hauling and loading units at work throughout the tunnel made it imperative to have a ventilating system that provided peak efficiency. To obtain the required efficiency, air is forced to the face through a 27-in. metal ventilating pipe. Power to push the air through this pipe is provided by electrically driven Joy fans, located at about 1,000-ft. intervals in the ventilating line. The fans and ventilating pipe are supported by bolts driven into the tunnel sidewards or hung on the structural steel. No appreciable amount of coal gas was found in the tunnel.

Service Facilities

The two headings are worked as independent operations. Each has its own extensive facilities that could take care of almost any maintenance or repair problem that might arise. In addition to maintenance and repair shops, each portal area contains compressor houses, fan installation, bit-sharpening units, warehouses, change

house, first-aid station, and office facilities.

Located at a safe distance from each portal are two widely separated explosives magazines, one for the storage of dynamite and the other for storing blasting caps. The dynamite storage magazine is of bulletproof steel construction, adequately ventilated, and kept securely locked. It will store approximately 30,000 lb. of dynamite. The blasting cap magazine is somewhat smaller and is of the underground type, being built into the side of a hill. It is well protected on the top and three sides by thick earthen barriers. The front of the cap magazine is built of several layers of sturdy oak planking.

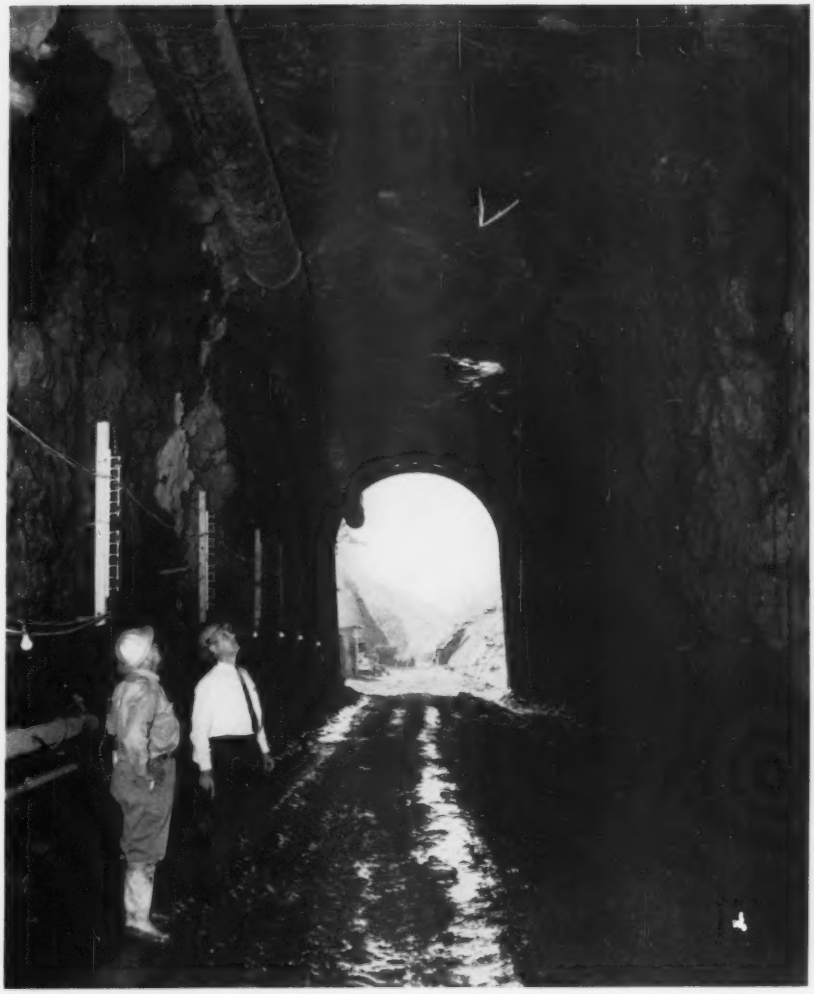
Safety Organization

That the Mills management is progressive in its outlook toward the safety of its workers is proved by the fact that there are qualified rescue and first-aid men working on each shift. There is always, either in the tunnel or in the portal service areas, one or more men qualified to render first aid regardless of the type of accident encountered. Many men working on the project are holders of the United Mine Workers First Aid Certificate and have also met the requirements of the United States Bureau of Mines by passing its comprehensive first-aid examination. Ambulances are stationed at each portal.

Key Personnel

Keeping a project the size of the Sandy Ridge Tunnel running smoothly and on schedule calls for close cooperation between the N & W engineering staff and the representatives of the construction company. The rapid progress being made toward completion of the tunnel proves that these two groups are working together harmoniously.

Construction of the tunnel is under the direction of A. B. Stone, chief engineer of the N & W system, and B. E. Crumpler, assistant to the chief engineer. General supervision is in charge of Division Engineer L. A. Durham, Jr. The resident engineers for the railway company are C. W. Fiery and W. B. Cole. For the Ralph E. Mills Company, the general superintendent and project manager is J. M. Lipscomb.



INSPECTING THE ROOF: Norfolk and Western's Division Engineer L. A. Durham, Jr., and Resident Engineer W. B. Cole inspect the roof at the south portal.

TUNNEL VETERANS: These three construction veterans have worked together on many construction projects: left to right, C. W. Fiery, resident engineer, Norfolk and Western Railway; Ralph E. Mills, president, Ralph E. Mills Company; and J. M. Lipscomb, project manager and general superintendent for the Mills organization.

Ghost Town

CHARLES F. THOMAS*

Creede, wild city praised in story,
Famed in words of poet's song,
Silvered land with golden glory,
Peopled once with crowding throng.
But no shouts are heard in playtime;
Tales are lost of stirring deed.
Now the days are drear in daytime,
And the nights are dark in Creede.

Where the toiling miner wrestled
Wealth from rugged Mother Earth,
Creede, whose nights seemed daytime, nestled
Mid the high hills' echoed mirth.
Old-time gamblers, girls of paytime,
Miners, mothers, every breed—
Now the days are lone in daytime,
And the nights are dark in Creede.

In Creede's graveyard, lone and cheerless,
On a rough, neglected hill
Rest the dead men, cowards or fearless,
And Creede's women, good with ill.
All faced hardship, bright or graytime;
Most earned joy in kindly deed.
Now the days are sad in daytime,
And the nights are dark in Creede.

From old shells of buildings dreary,
Once saloons or dancehalls bright,
Is that music? Ghostly, eerie,
Played for spirits of the night?
But sad hearts must dream the gaytime,
And there man is lone, indeed,
For the days are still in daytime,
And the nights are dark in Creede.

Mines deserted, rotted headframes
Stand like gallows on the hills.
Once-famed names are now just dead names;
Still, abandoned are the mills.
Here the winter's snow in Maytime
Casts cold chill on summer's seed.
Long, too long are days in daytime,
Dark, so dark are nights in Creede.

*Palmdale, California

The Oahe Dam On the Missouri River

This key structure in the Missouri River Basin will control floods, provide irrigation waters, and improve navigation in a ten-state area

L. H. HOUCK*

THE Oahe Dam, one of the largest earth-fill structures of its kind in the world built by the load-and-haul method, is rising on the Missouri River at Pierre, South Dakota. It is part of a comprehensive plan of the U. S. Army Corps of Engineers to convert the destructive floods of the cantankerous Missouri into a force that will provide widespread benefits for almost one-sixth of the nation.

The dam, and the 250-mile-long reservoir it will create, are in historic country. From these same bluffs Indians, buffalo, and prairie dogs watched Lewis and Clark begin the march of the white man to take over the Great Plains. White men, Indians, prairie dogs, and rattlers remain, but the buffalo has been replaced by its white-faced Hereford cousins. To the west lie the historic Bad Lands and the famed Black Hills.

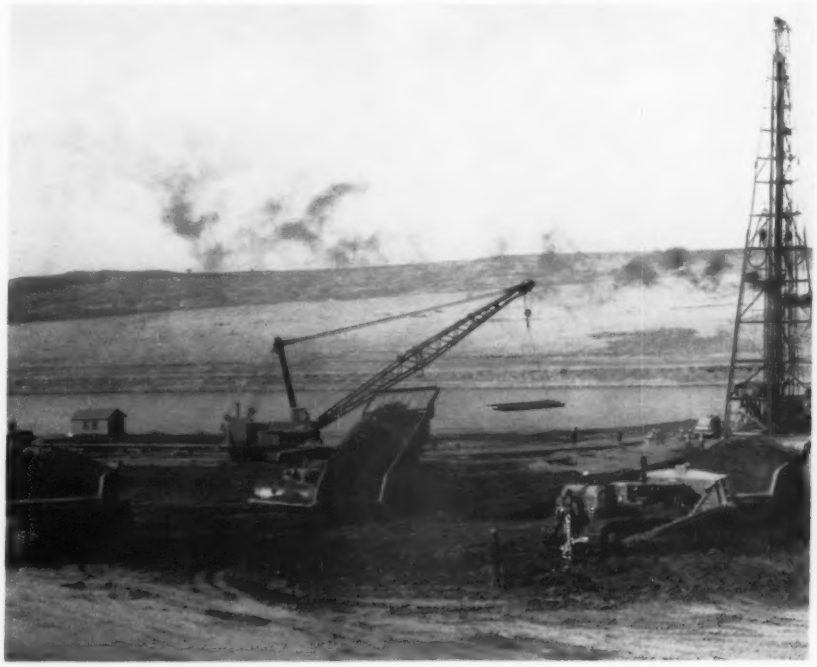
Aptly taking its name from an Indian word meaning "foundation," the Oahe Dam is a key project in the development of the 529,000-sq. mi. Missouri basin. It will be operated in conjunction with the Fort Peck, Garrison, Big Bend, Fort Randall, and Gavins Point Dams. Providing water to irrigate large areas of arid and semiarid lands, it will also control floods from Pierre, South Dakota, to the mouth of the Missouri at St. Louis, a distance of 1,123 miles. It will also be a boon to increased river navigation, providing navigation water for an authorized 9-ft. channel from Sioux City, Iowa, to the Mississippi.

*400 Linden Drive
Jefferson City, Missouri

Power will be generated in wholesale quantities at moderate cost, with 595,000 kw. available to a region where a power shortage was predicted. It will activate recreation and wildlife potentialities along the vast shoreline of a lake 250 miles long.

Historic streams flow into the Missouri. Each brings its own flood waters or dries to a starvation trickle. Among them are the Big Horn, the Cheyenne, the Platte, the Kansas, the Sioux, the Yellowstone, and the Osage, each contributing its part to the unruly Missouri. One flood alone cost 36 lives and millions of dollars in damages. In other years, the flow of the stream dwindled to a trickle. Towns suffered water shortages, farms dried up, and the winds attacked the highly erosible soil.

These ravages of the elements now are blamed for a population decrease in the basin during the past 25 years, while increases occurred in most other parts of the country.



ACTIVITY ON THE WEST BANK: At the right in the illustration is shown a steam-powered pile driver sinking steel piling near the center of the dam site. A Manitowoc Model 4500 crane lays track ahead of the pile driver to facilitate its advancement. Euclid and Mack trucks haul fill while dozers level out the fill material. Beyond this scene of activity is the Missouri River.

EXCELLENT FRAGMENTATION: In this shale formation in the spillway area, excellent fragmentation was obtained by loading 4 lb. of Gelamite 1 and 50 lb. of Hercules E. P. 197C in each hole. Blasting techniques and type of explosives used were varied to meet conditions.

LOADING BLASTED SHALE: Normally equipped with an 11-cu. yd. dipper, this Model 191-M Marion shovel was modified so that a 13-cu. yd. dipper could be used to load out the shale from the spillway on the west bank. Working from a 25-ft.-deep cut, the Marion loaded the well-broken shale into trucks of 50-ton capacity.

Involving an area of 529,000 sq. mi., the Missouri River Basin represents a sixth of the land area of the United States. It includes all or part of ten states: Montana, Wyoming, Colorado, North and South Dakota, Nebraska, Kansas, Iowa, Missouri, and Minnesota. The basin, extending northwestward from the Mississippi at St. Louis to Helena, Montana, is more than 1,300 miles long and 700 miles wide.

Construction Started in 1948

Construction work on Oahe Dam was started in 1948 and is scheduled for completion in 1965. Plans call for the first power unit to be turned on in July, 1963.

It will be a rolled-earth type of structure, 9,300 ft. long and 242 ft. high, with protection from wave action by riprapping the upstream face. The Oahe ranks second to Fort Peck in height—250 ft. The huge embankment will contain 91,000,000 cu. yd. of earth. Installation of the power facilities will require 348,000 cu. yd. of concrete.

An interesting feature is the remote location of the 670-ft.-long spillway with a gated chute and a 2-mile-long approach channel. The crest of the spillway is 1,596.5 ft. above mean sea level, and 456 ft. wide. It will require 360,000 cu. yd. of concrete. The spillway will handle 300,000 cu. ft. of water a second when the pool is at maximum.

The outlet works will consist of six concrete-lined tunnels through the west abutment, each 19.75 ft. in diameter. For each tunnel of the outlet works, there will be a 54 by 90-ft. reinforced-concrete intake structure, normally submerged, and a flow-control shaft 38 ft. in diameter.

Power Facilities

The power works, located on the downstream side of the dam in the east abutment, will require 33,000,000 cu. yd. of excavation. Complete installation of the generating plant has been authorized.

Seven gate-controlled tunnels, each 24 ft. in diameter and an average of 3,440 ft. long, will carry water to seven 85,000-kw. generating units. These seven units will provide a total generating capacity of 595,000 kw.

The overall project, with its multiple features of power, irrigation, and recreation, is expected to stimulate the industrial, commercial, and agricultural development of the region as well as to provide a cash revenue that will be returned to the government.

An interesting provision for the future is the installation of a wye branch in the penstock of the landward tunnel upstream from the powerhouse, which will supply water to a large pumping plant for irrigation. This water can be supplied to either the power plant or the irrigation pumping plant.

As indicated previously, the reservoir and lake created by the dam will form one of the largest man-made lakes in the world. It will extend 250 miles upstream to within 5 miles of Bismarck, North Dakota. At full operating level, the surface area totals 376,000 acres, and the maximum depth will exceed 200 ft. Maximum capacity of the reservoir will be 23,600,000 acre-feet, of which 3,500,000 acre-feet will be primarily for flood control. A conservation pool of 5,500,000 acre-feet will be provided at minimum levels. Normally 14,600,000 acre-feet of the total will be available for the multiple purposes of the dam such as power and irrigation.

Western Contracting's Activities

Western Contracting Corporation of Sioux City, Iowa, is now working on its fifth contract on Oahe Dam. Its first contract involved 6,400,000 cu. yd. of excavation of overburden and shale, and the construction of approximately 6,000,000 cu. yd. of dam embankment. This contract was started in 1952 and completed early in 1953.

Western Contracting's second contract covered the construction of the first major earth-moving job on the left bank of the river. Work was started early in 1955 and completed in 1956. Excavation amounted to 22,140,000 cu. yd., and 21,255,000 cu. yd. of embankment was put in place.

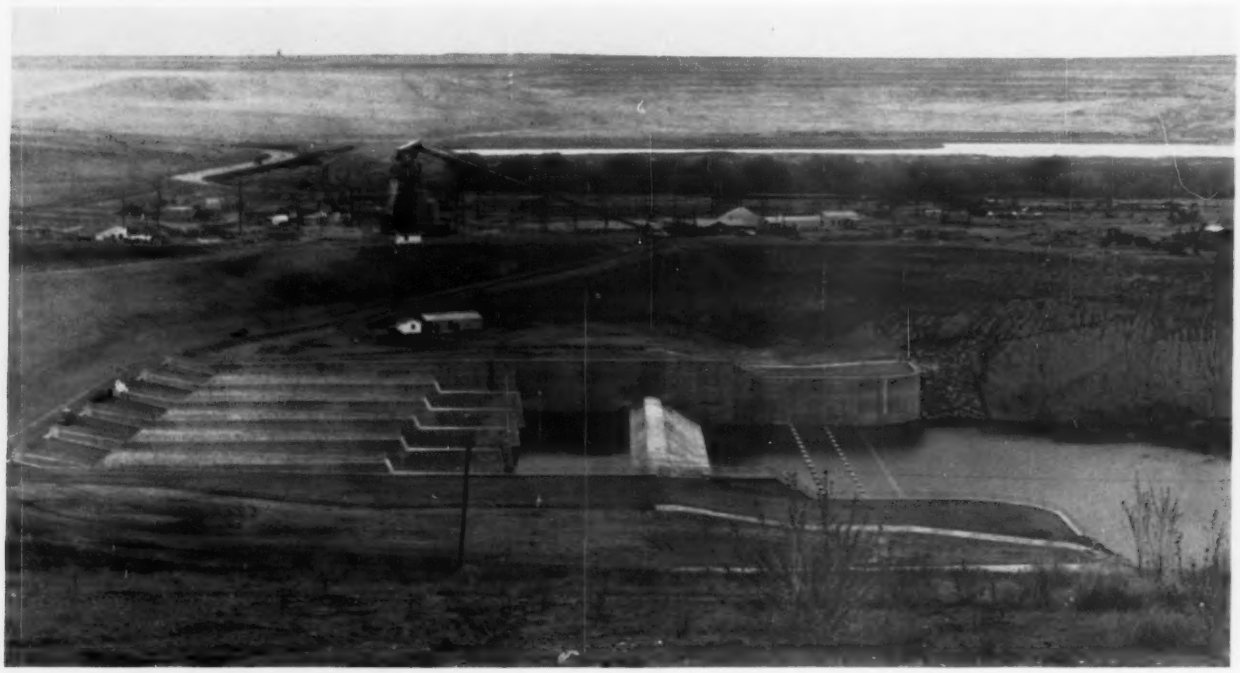
Western's third contract involved the excavation of a part of the spillway, comprising approximately 5,000,000 cu. yd. of shale and overburden. This material was unsuitable for use and was wasted. This contract completed the 1956 construction season.

All of these contracts involved king-size quantities and Western used king-size equipment and operating procedures in handling them. For instance, some of the star performers in Western's stable of equipment were 191-M Marion shovels and draglines with 11-cu. yd. dippers and buckets. These units are the largest machines made to operate on two crawlers. To haul the huge quantities of excavated materials, 50-, 30-, and 25-ton Euclid and Mack end-dump trucks were used. They were supplemented with Euclid TS-24 twin scrapers, each with 24-cu. yd. capacity.

Western's fourth contract involved about 19,000,000 cu. yd. of excavation and about the same amount of embankment in the left bank. This contract, started late in 1956, was completed on November 30, 1957.

Western's fifth, and present, contract specifies the excavation of approximately 24,500,000 cu. yd. of overburden and shale, and the construction of 12,000,000 cu. yd. of embankment. The closure of the dam for diversion, scheduled for August, 1958, is included in this contract. The work details are planned for completion in February, 1960.

Some total figures are presented here to give a picture of the size of this gigantic project: total fill, 91,000,000 cu. yd.; total concrete, approximately 800,000 cu. yd.; total cost $380,000,000.



STILL BASIN: Far from the Missouri River, shown in the background, the still basin is rapidly nearing completion.

MAMMOTH TRUCK: Designed by the Western Contracting Corporation, this 80-cu. yd. dump truck may well be the world's largest truck. Dwarfed by the truck are H. H. Everist, Jr., of Western Contracting Corporation; General G. E. Galloway; Colonel D. G. Hammon; and John W. Sibert, Jr., area engineer, Corps of Engineers, U. S. Army.

World Earth-Moving Record

How large Oahe Dam is and how big a job is being done by Western is better understood when it is known that on May 16, 1956, more material was moved by the load-and-haul method than on any other single earthworks job any place in the world in a 24-hour period by one contractor. On that day, Western, working its usual two 10-hour shifts, moved 145,000 cu. yd. of earth.

Blasting was required in all of Western's five contracts except the first. The contractor's crews had to contend with an impressive range of conditions —rocks and boulder formation on the east side of the river, and the hard, tricky Pierre shale on the west side.

When the prehistoric glaciers swept down ages ago and pushed the rock formations into the glacial till land of the east bank, they stopped at the river and then retreated, leaving the west bank in its pristine state. The formations were not disturbed until construction work on the Oahe Dam was started. The west bank is composed of black shale, which is hard and compact when dry, slick and soapy when wet. Much of it had to be broken up with dynamite for economical excavation.

With work on the east bank completed, Western is now occupied with 7,600,000 cu. yd. of excavation in the spillway on the west bank. This requires deep cuts in the Pierre shale.

The spillway is 465 ft. wide, 6,000 ft. from the west abutment, and has an unlined channel 2 miles long. It is in the spillway that most of the blasting is required in the present contract.

Blasting Procedure

Holes for blasting, 4½ in. in diameter and 25 ft. deep, are drilled on 18-ft. centers in the Pierre shale with a Reich rotary blast-hole drill mounted on a D8 Caterpillar tractor. Since these holes were drilled in a matter of minutes, the loading crew followed closely behind the drill rig to load the holes with 4 lb. of Gelamite® 1 and 50 lb. of Hercules® E. P. 197C. In this formation, this combination of explosives produced approximately 300 cu. yd. of blasted shale per hole. In other formations, the explosives loading factor was 0.2 lb. per each cu. yd. in place. Gelamite was used in 3 by 24-in. cartridges.

Most of the time, the Reich drill put down plenty of blast holes ahead of excavation. But, sometimes two drill rigs were required. The second drill was a Failing mounted on an International L-180 truck, with air supplied from a Mobil-Air Ingersoll-Rand compressor powered with a 6-71 GMC diesel.

Usually, blasts were fired in 27-hole rounds. Since they were gauged to fracture the material without much heave or throw, it was necessary to flag the adjacent traffic only momentarily. In some instances, however, 40 to 50 holes were fired at a time. The detonators used were Hercules® Electric Blasting Caps with 12-ft. leg wires. The cap leg wires were connected to a Primacord* main line. Blasts were fired with an electric blasting machine.

The formation encountered determined the type of explosives used and the method of loading. As an example, holes 10 ft. deep or less were loaded with Gelamite 1 exclusively. The number of holes to each round, use of delay or non-delay caps, pattern of drilling, and the explosives loading ratio varied considerably with the difference in formations on each side of the river. All blasts were designed to produce a cubic yard of broken material for each ¼ lb. of explosives used.

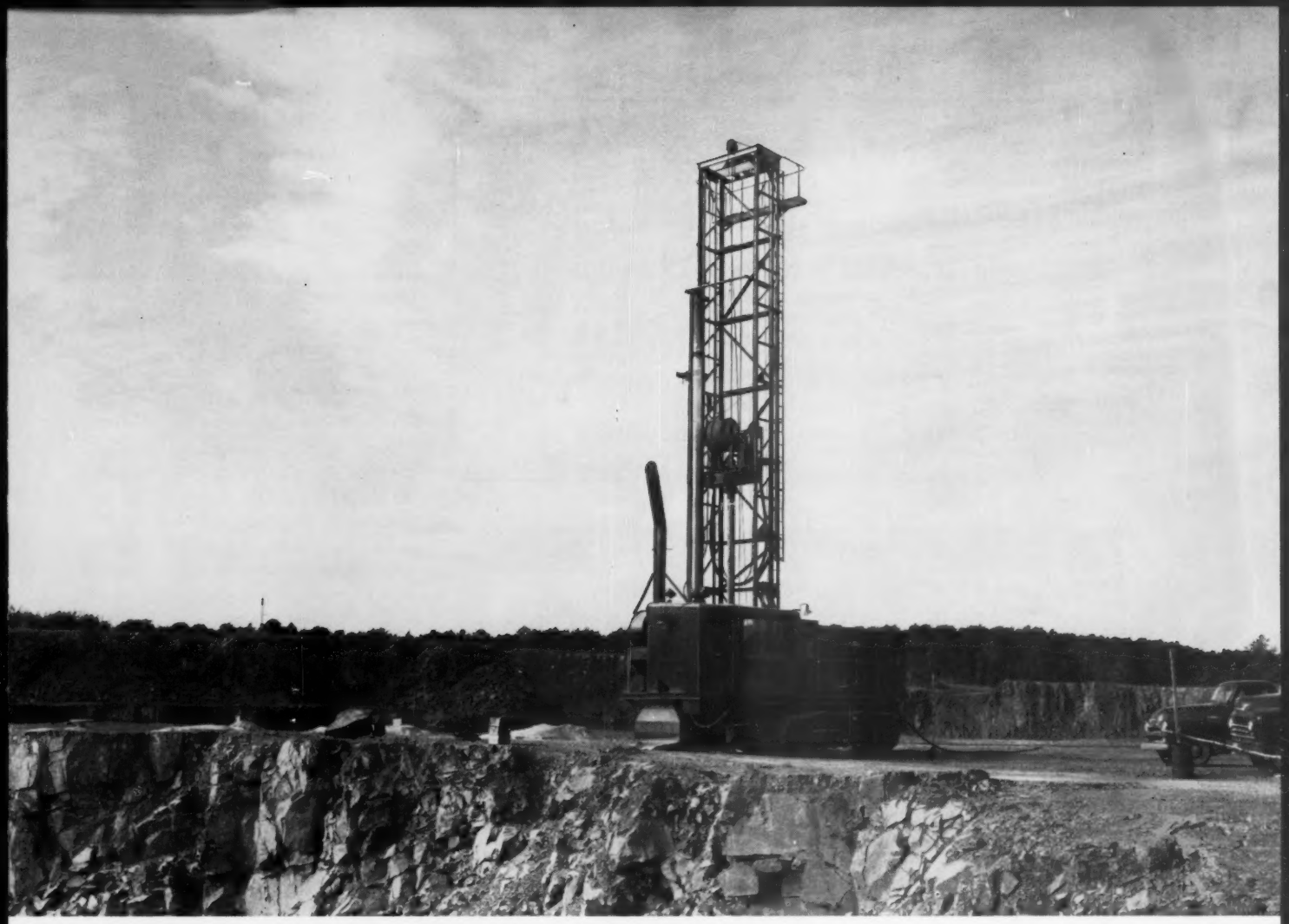
Loading and Hauling

The loading equipment is impressive. At work on this job for Western are a 191-M Marion with a 14-cu. yd. bucket (dragline hookup), and two Marion 191-M shovels with 13-cu. yd. dippers. As indicated previously, these are the largest machines made to operate on two crawlers. Other loading equipment includes a 151-M Marion dragline with 8-cu. yd. bucket, and a Manitowoc Model 4500 swinging an 8-cu. yd. bucket.

While most of the shovels and draglines are electrically operated, Western has its own power plants to supply electric power so that it can operate at will from commercial lines or from its own generators.

(Continued on page 126)

*Reg. U.S. Pat. Off.
By The Ensign-Bickford Company



Wisconsin Quarry Adds 50-R to Speed Up Blast Hole Drilling

Just north of Wausau, Wis., Foley Brothers installed a 50-R drill at a rock quarry. Formations run to tough, hard-to-drill quartz and granite. Even in material like this, Bucyrus-Erie rotaries put down a lot of hole—fast.

Two important features make the 50-R unequalled for drilling in tough formations: *variable drilling speed* and *variable down pressure.*

For controlled speed, the Ward Leonard variable voltage system gives the operator smooth, instant command over rotation of the drill pipe. He can choose the most efficient speed for a given formation. To meet requirements, he can vary the speed without stopping the drilling operation.

Hydraulic pulldown provides controlled load on drilling tools. For greatest possible penetration in hard rock, maximum down pressure can be exerted on the bit while the drill pipe is turning slowly.

The 50-R at Foley Brothers is a full-electric rig designed for drilling 9⅞ to 12¼-in. holes. For drilling 6¾ to 9-in. holes Bucyrus-Erie offers the 40-R with either full electric or diesel-electric power.

Get the full story on these drills today. Contact us direct for illustrated bulletins. Bucyrus-Erie Company, South Milwaukee, Wisconsin.

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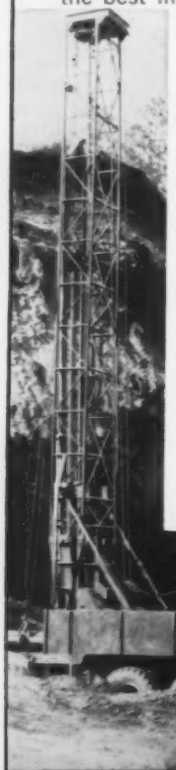
• Gardner Denver AM6 Mole Dril
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The Oahe Dam on the Missouri River

(Continued from page 124)

One of the 191-M Marions was assigned to the spillway job on the west bank to handle the blasted shale. Normally an 11-cu. yd. machine, it was equipped with a 13-cu. yd. dipper. Cutting a path 25 ft. deep, it brought up full dippers with every swing, indicating that the formation had been blasted successfully.

The hauling equipment working with the shovels and draglines includes 30 Model LLD 50-ton end-dump Euclid trucks powered with two 300-hp. Cummins diesels; 25 Euclid 25-ton bottom-dump trucks with GMC diesels; and 11 Mack 30-ton end-dump trucks with Mack diesels.

Assigned to the 191-M Marion in the spillway is a mixed fleet of 50-ton Euclids and 30-ton Macks. Since the big dipper fills a truck in two or three swings, trips to the dumping area are on an average of 6½ minutes. Actually, it took longer to dump the loads in the assigned areas, even though dumped on the run, than it did to load the big trucks.

In addition to the big dump trucks, Western was moving tremendous quantities of blasted terrain and virgin ground with a fleet of 25 Euclid TS-24 twin-power scrapers, with a GMC 110 diesel in front and a 6-71 in the rear; and 11 single-engine Euclid scrapers. These were push-loaded by a fleet of TC-12 Euclid twin-crawler tractors. Many times they are used to push in tandem because of the hard going in the unblasted shale.

Western Contracting Corporation maintains headquarters in Sioux City, Iowa. Its supervisory personnel at the Oahe Dam job includes Carl "Rip" Collins, project manager; A. "Blackie" Blackwell, superintendent; Bob Cressman, night superintendent; Jack Leppard, excavation superintendent; Mac Sanmann, master mechanic; and James Ritter, blasting foreman.

The Corps of Engineers, U. S. Army, is represented by John W. Sibert, Jr., area engineer, and Lew Leavitt, resident engineer. Colonel D. G. Hammon is the district engineer of the Omaha District.

NEWS NOTES

ALL-NEW POWER TAKE-OFF ROTARY AIR COMPRESSOR

Production of a truck-mounted Power Take-Off Rotary Air Compressor has been announced by the Worthington Corporation, Harrison, New Jersey. Sixty per cent lighter than conventional compressors used by utilities for construction, maintenance, and repair work, the self-contained unit is 38 in. long, 28 in. wide, and 39 in. high, taking up only 40 per cent of the space required by other compressors.

The power take-off unit is belt-driven and completely controlled from the cab. Its variable capacity control allows it to produce more air than conventional reciprocating machines—maintaining a consistent delivery of 125 cu. ft. of air per minute at a pressure of 100 p.s.i.

The complete unit, weighing 950 pounds, includes a two-stage, oil-cooled rotary air compressor, speed control, engine governor, oil cooler, air storage tank, oil separator, and storage receiver, all mounted on a common base. Low starting and break-away torque hold engine maintenance to a minimum.

SELF-ADJUSTING FLOODLIGHTS

A line of outdoor floodlights announced by Stonco Electric Products Company, Kenilworth, New Jersey, features a patented full-floating socket construction that the maker claims insures a perfect weatherseal and positive electric contact with all makes of reflector lamps. By "floating" the socket in a cushion-spring cradle that adjusts automatically to variations in lamp sizes and shapes, common causes of premature lamp failure are practically eliminated. Excessive vibration, shock or pole whip, arcing, socket corrosion, water seepage are such causes. The result is a highly effective, economical, all-purpose weatherproof floodlight suited for outdoor applications where floodlights must stand up in rain or sleet.

The new line is made for medium or mogul base reflector lamps in 75 to 500-watt sizes and is accompanied by a wide variety of mounting devices for pole top or wall mounting singly or in clusters for wide area floodlighting. All units are fully UL-approved and CSA-approved for outdoor weatherproof service. Additional data may be secured from the manufacturer.

NEW METHOD FOR DETERMINING ROCK DEPTH

A new technique for locating rock without the necessity for drilling has been announced by Geophysical Specialties Company. The manufacturer claims that by using sound waves in the earth produced by an impact on the ground surface, the MD-1 Refraction Seismograph permits determination of depth to bedrock with an accuracy of 5-10%, or alternatively permits determining whether or not rock exists within any specified depth range from the surface to 50 ft. or more. Simple, rapid operation offers the mine or quarry operator a means for locating new quarries, extending present ones, or estimating stripping costs, all with major reductions in exploration expense.

For additional information write to Geophysical Specialties Company, 4206 Longfellow Avenue, Minneapolis, Minnesota.

COLUMBIA AC-DC VOLTMETER

A quick means of measuring voltages up to 600 volts, AC or DC, is now available through the new portable Columbia Model UV-1 Voltmeter which is compactly designed to fit into the palm of the hand. Made of durable molded plastic material and weighing only nine oz., the Model UV-1, size 2 in. by 2⅞ in. x 4⅝ in., can easily be carried in the average pocket. Readings are easily taken by first inserting the safety plug into a receptacle on the instrument and then connecting the voltage leads to the line. One lead is equipped with an insulated clip, the other with an insulated prod.

By the use of a simple rotary switch, the user can select one of four voltage ranges: 0-150 AC, 0-150 DC, 0-600 AC, or 0-600 DC. The 0-150 scale with five volt divisions and the 0-600 scale with 20 volt divisions afford ease of reading any voltage from 0 to 600 volts. Accuracy is 2% on DC, 3% on AC (full-scale deflection), the manufacturer states.

For further information and price, write Columbia Electric Mfg. Co., 4535 Hamilton Avenue, Cleveland 14, Ohio.

FIRST-AID KIT CONTENTS INDEXED

The General Scientific Equipment Company of Philadelphia, Pennsylvania, has announced a new line of heavy-duty unit first-aid kits designed to facilitate emergency treatment through the use of unit-wrapped items, boldly labeled and arranged for immediate recognition and access.

Each G-S Unit-Type Kit has a facsimile index on the inside of the case lid which shows at a glance the exact location of all items and gives concise instructions for their use. The index also serves as a positive inventory control, since any missing items can be quickly identified from the facsimile table.

Cases are made of 20-gauge steel, finished in either olive green or gray baked-on enamel. Lids are hinged along the entire length of one side and are fitted with a rubber gasket to keep out dust and dampness. Integral mounting brackets and carrying handle permit the kits to be used for permanent wall installation or portable service.

Complete information may be obtained by requesting Bulletin 305 from General Scientific Equipment Co., 7316 Limekiln Pike, Philadelphia 50, Pennsylvania.

ALUMINUM SAFETY CAP

A vertically taper-ribbed aluminum safety cap, called "SuperLite," is being produced by The Fibre-Metal Products Company. Although light in weight, its design enables maximum impact resistance. The girderlike construction of the cap is not only completely rigid but its unique design presents maximum deflection characteristics to blows or falling objects. The "shell" is of tough, tempered aluminum. It is cool in that it reflects and does not absorb heat.

The SuperLite cap's "suspension" is of resilient, shock-absorbing, form-fitting polyethylene. It shapes to the wearer's head for ideal comfort and makes the cap "stay put" in any working position. The suspension "floats" the headband to avoid direct head contact with the cap shell and for full ventilation. The suspension is mildew- and fungus-proof, non-toxic, and easily sterilized, according to the manufacturer.

Complete information may be obtained by writing The Fibre-Metal Products Company, Fifth and Tilghman Streets, Chester, Pennsylvania.

SELF-PROPELLED TRAC-DRILL

Joy Manufacturing Company announces the introduction of a new air-powered, self-propelled TDM Trac-Drill. Designed to carry the Joy TM-450 Drill, the machine is capable of drilling 3½-in.-diameter blastholes to a depth of 40 ft. or more.

Completely power-operated, the TDM Trac-Drill offers an almost infinite range of drilling positions. The manufacturer claims it is capable of drilling from the toe hole position of minus 10° at ground level up through vertical and to 45° forward of vertical. Horizontal holes approximately 8 ft. above ground level can be drilled. True vertical holes can be drilled on a 45° grade. Also up-holes can be drilled at any angle up to 45° above horizontal; and, the feed tilts 15° to either side of vertical, allowing true vertical holes to be drilled on uneven terrain.

The TDM Trac-Drill is available with feeds for handling 10-ft. coupled steels. It can also be equipped with an air-powered winch for handling and uncoupling drill steel.

For more information write to Joy Manufacturing Co., Oliver Building, Pittsburgh 22, Pennsylvania.

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For the first time, a scientific 16-mm. color movie is available to industrial explosives users to help explain the facts about vibrations from blasting.

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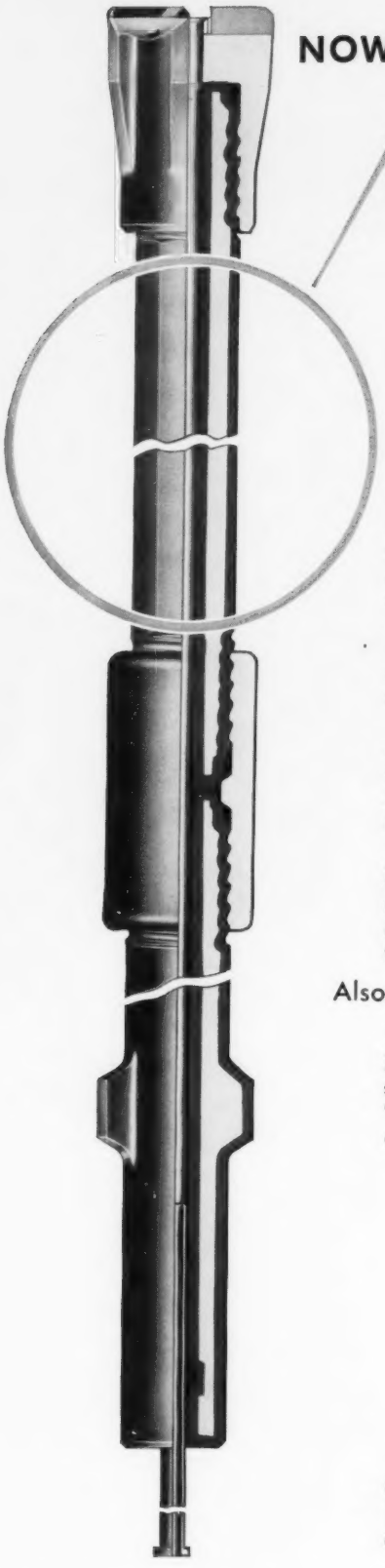

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		2⅛"	1	5
		2¼"	1	8
Type 22	1¼" O.D. Thread, 3 threads per inch	2"	1	2
		2⅛"	1	5
		2¼"	1	8

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